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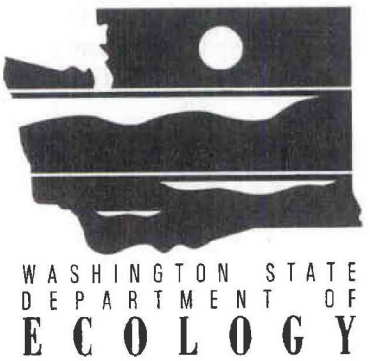
Seattle City Light comments
EPA comments
Boeing comments
SAIC comments/questions



Lower Duwamish Waterway Source Control Action Plan for the Slip 4 Early Action Area

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WASHINGTON STATE DEPARTMENT OF ECOLOGY

Draft
Lower Duwamish Waterway Source Control Action Plan for the Slip 4 Early Action Area

Produced by
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With Assistance from:

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Abstract

The Lower Duwamish Waterway, located in Seattle, Washington, was added to the National Priorities List (Superfund) by the U.S. Environmental Protection Agency (EPA) on September 13, 2001. Chemicals of concern found in waterway sediments include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), mercury and other metals, and phthalates. These chemicals of concern may pose threats to people, fish, and wildlife.

In December 2000, EPA and the Washington State Department of Ecology (Ecology) entered into an order with King County, the Port of Seattle, the City of Seattle, and The Boeing Company to perform a Remedial Investigation (RI) and Feasibility Study (FS) of sediment contamination in the waterway. EPA is the lead agency for the RI/FS. Ecology is the lead agency for controlling current sources of pollution to the site, in cooperation with the City of Seattle, King County, the Port of Seattle, the City of Tukwila, and EPA.

Phase 1 of the RI/FS used existing data to identify potential human health and ecological risks, information needs, and high priority areas for cleanup ("early action areas"). The Slip 4 Early Action Area (EAA) is one of seven EAAs identified by EPA and Ecology.

Sections 1 and 2 of this Source Control Action Plan (Action Plan) provide background information about the Lower Duwamish Waterway site and the Slip 4 EAA. Section 3 describes potential sources of contamination that may affect sediments in Slip 4, and evaluates the significance of those potential sources. Section 4 identifies the actions that are planned or underway to control these potential sources as well as the sampling and monitoring activities that will be conducted to identify additional sources and assess progress. In addition, this Action Plan describes how these source control efforts will be tracked and reported.

Acknowledgements

The Department of Ecology would like to thank the members of the interagency Lower Duwamish Waterway Source Control Work Group for their contributions and support in developing this Action Plan:

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Acronyms/Abbreviations

AFF	Aviation Fuel Farm
AGE	Aerospace Ground Equipment
ANG	Air National Guard
ANGS	Air National Guard Station
AOC	Air Operations Center
BEHP	bis(2-ethylhexyl)phthalate
BMP	Best Management Practice
BNA	Base Neutral Extractable Acids
CDWAA	Central Dangerous Waste Accumulation Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CFR	Code of Federal Regulations
CPAH	Carcinogenic Polycyclic Aromatic Hydrocarbon
CSCS	Confirmed or Suspected Contaminated Sites
CSL	Cleanup Screening Level (Washington State Sediment Management Standards)
CSO	Combined Sewer Overflow
DDE	Dichlorodiphenylethylene
DDT	Dichlorodiphenyltrichloroethane
DSOA	Duwamish Sediment Other Area
DW	Dry Weight
EAA	Early Action Area
Ecology	Washington State Department of Ecology
EOF	Emergency Overflow
EPA	United States Environmental Protection Agency
ERM	Environmental Resources Management
ERTS	Environmental Report Tracking System
FOIA	Freedom of Information Act
FS	Feasibility Study
GTSP	Georgetown Steam Plant
HPAH	High Molecular Weight Polycyclic Aromatic Hydrocarbon
KCIA	King County International Airport
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
LPAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbon
LUST	Leaking Underground Storage Tank
MEK	Methyl ethyl ketone
MLLW	Mean Lower Low Water
MTCA	Washington State Model Toxics Control Act
NAPL	Non-aqueous Phase Liquid

NBF	North Boeing Field
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OC	Organic Carbon
OWS	Oil/Water Separator
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PNA	Polynuclear Aromatic
PSDDA	Puget Sound Dredged Disposal Analysis
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RM	River Mile
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCL	Seattle City Light
SCWG	Source Control Work Group
SD	Storm Drain
SEA	Striplin Environmental Associates
SI	Site Investigation
SL	Screening Level
SMS	Sediment Management Standards
SPCC	Spill Prevention Control and Countermeasures
SPU	Seattle Public Utilities
SQS	Sediment Quality Standards
SVOC	Semi-volatile Organic Compound
SWMM	Stormwater Management Model
SWPPP	Stormwater Pollution Prevention Plan
TLC	Thin Layer Chromatography
TPH	Total Petroleum Hydrocarbons
TSD	Treatment, Storage, or Disposal
TCE	Trichloroethylene
USCG	United States Coast Guard
UST	Underground Storage Tank
VOC	Volatile Organic Compound

1.0 Introduction

This Source Control Action Plan (Action Plan) describes potential sources of contamination that may affect sediments in and adjacent to Slip 4. The purpose of this plan is to evaluate the significance of these sources and to determine if actions are needed to minimize the potential for recontamination of Slip 4 sediments. In addition, this Action Plan describes:

- source control actions/programs that are planned or currently underway
- sampling and monitoring activities that will be conducted to identify additional sources and assess progress, and
- how these source control efforts will be tracked and reported.

The information in this document was obtained from a variety of sources, including the following documents:

- *Summary of Existing Information and Identification of Data Gaps*, Striplin Environmental Associates, 2004.
- *Lower Duwamish Waterway Slip 4 Early Action Area Engineering Evaluation/Cost Analysis* (Draft), Integral Consulting, Inc., 2005a.
- Dan – what other documents should be listed here?

1.1 Organization of Document

Section 1 of this Action Plan describes the Lower Duwamish Waterway site, the strategy for source control, and the responsibilities the public agencies involved in source control for the Lower Duwamish Waterway. Section 2 provides background information on the Slip 4 Early Action Area (EAA), including the a description of the chemicals of concern for Slip 4 sediments. Section 3 provides an overview of potential sources of contaminants that may affect Slip 4 sediments, including pipe outfalls, spills, properties adjacent to Slip 4, and upland properties. Actions planned or currently underway to control potential sources of contaminants are described in Section 4, while Sections 5 and 6 describe monitoring and tracking/reporting activities, respectively.

1.2 Lower Duwamish Waterway Site

The Lower Duwamish Waterway is the downstream portion of the Duwamish River, extending from the southern tip of Harbor Island to just south of Turning Basin 3 (Figure 1). It is a major shipping route for bulk and containerized cargo. Most of the upland areas adjacent to the Lower Duwamish Waterway have been developed for industrial and commercial operations. These include cargo handling and storage, marine construction, boat manufacturing, marina operations, concrete manufacturing, paper and metals fabrication, food processing, and airplane parts manufacturing. In addition to industry, the river is used for fishing, recreation, and wildlife habitat. Residential areas near the waterway include the South Park and Georgetown neighborhoods.

Beginning in 1913, this portion of the Duwamish River was dredged and straightened to promote navigation and industrial development, resulting in the river's current form. Shoreline features within the waterway include constructed bulkheads, piers, wharves, buildings extending over the water, and steeply sloped banks armored with riprap or other fill materials (Weston 1999a). This development left intertidal habitats dispersed in relatively small patches, with the exception of Kellogg Island, which is the largest contiguous area of intertidal habitat remaining in the Duwamish River (Tanner 1991). Over the past 20 years, public agencies and volunteer organizations have worked to restore intertidal and subtidal habitat to the river. Some of the largest restoration projects are at Herring House Park/Terminal 107, Turning Basin 3, Hamm Creek, and Terminal 105.

The presence of chemical contamination in the Lower Duwamish Waterway has been recognized since the 1970s (Windward 2003a). In 1988, the U.S. Environmental Protection Agency (EPA) investigated sediments in the Lower Duwamish Waterway as part of the Elliott Bay Action Program. Problem chemicals identified by the EPA study included metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), phthalates, and other organic compounds. In 1999, EPA completed a study of approximately 6 miles of the waterway, from the southern tip of Harbor Island to just south of the turning basin near the Norfolk combined sewer overflow (Weston 1999a). This study confirmed the presence of PCBs, PAHs, phthalates, mercury, and other metals. These chemicals may pose threats to people, fish, and wildlife.

In December 2000, EPA and the Washington State Department of Ecology (Ecology) signed an agreement with King County, the Port of Seattle, the City of Seattle, and The Boeing Company, collectively known as the Lower Duwamish Waterway Group (LDWG). Under the agreement, the LDWG is conducting a Remedial Investigation (RI) and Feasibility Study (FS) of the Lower Duwamish Waterway to assess potential risks to human health and the environment and to evaluate cleanup alternatives. The Remedial Investigation for the site is being done in two phases. Results of Phase 1 were published in July 2003 (Windward 2003a). The Phase 1 RI used existing data to provide an understanding of the nature and extent of chemical distributions in Lower Duwamish Waterway sediments, develop preliminary risk estimates, and identify candidates for early cleanup action. The Phase 2 RI is currently underway and is designed to fill critical data gaps identified in Phase 1. Based on the results of the Phase 2 RI, additional areas for cleanup may be identified. During Phase 2, a Feasibility Study will be completed that will address cleanup options for contaminated sediments in the Lower Duwamish Waterway.

On September 13, 2001, EPA added the Lower Duwamish Waterway to the National Priorities List. This is EPA's list of hazardous waste sites that warrant further investigation and cleanup under Superfund. Ecology added the site to the Washington State Hazardous Sites List on February 26, 2002.

An interagency Memorandum of Understanding signed by EPA and Ecology in April 2002 and updated in April 2004, divides responsibilities for the site (EPA and Ecology 2002, EPA and Ecology 2004). EPA is the lead for the RI/FS, while Ecology is the lead for source control issues.

In June 2003, the *Technical Memorandum: Data Analysis and Candidate Site Identification* (Windward 2003b) was issued. Seven candidate sites for early action were recommended (Figure 2). The sites are:

Area 1: Duwamish/Diagonal combined sewer overflow (CSO) and storm drain

- Area 2: River mile (RM) 2.2, on the west side of the waterway, just south of the 1st Avenue South Bridge
- Area 3: Slip 4 (RM 2.8)
- Area 4: South of Slip 4, on the east side of the waterway, just offshore of the Boeing Plant 2 and Jorgensen Forge properties (RM 2.9 to 3.7)
- Area 5: Terminal 117 and adjacent properties, located at approximately RM 3.6, on the west side of the waterway
- Area 6: RM 3.8, on the east side of the waterway
- Area 7: Norfolk CSO (RM 4.9 to 5.5), on the east side of the waterway

Of the seven recommended early action sites, four either had sponsors to begin investigations or were already under investigation by a member or group of members of the LDWG. These four sites are: Slip 4 (the subject of this Action Plan), Terminal 117, Boeing Plant 2, and Duwamish/Diagonal. EPA is the lead for managing cleanup at Terminal 117 and Slip 4. The other two early action cleanup projects were started before the current Lower Duwamish Waterway RI/FS was initiated. Cleanup at Boeing Plant 2 (under EPA RCRA management) is currently in the planning stage. The Duwamish/Diagonal cleanup (under King County management as part of the Elliott Bay-Duwamish Restoration Program) was partially completed in March 2004. Early action cleanups may involve members of the LDWG or other parties as appropriate. Planning and implementation of early action cleanups will be conducted concurrently with the Phase 2 investigation.

Further information about the Lower Duwamish Waterway can be found at:
http://yosemite.epa.gov/r10/cleanup.nsf/sites/lduwamish and
http://www.ecy.wa.gov/programs/tcp/sites/lower_duwamish/lower_duwamish_hp.html

1.3 Lower Duwamish Waterway Source Control Strategy

The Lower Duwamish Waterway Source Control Strategy (Ecology 2004) describes the process for identifying source control issues and implementing effective source controls for the Lower Duwamish Waterway. The basic plan is to identify and manage sources of potential contamination and recontamination in coordination with sediment cleanups. The goal of the strategy is to minimize the potential for recontamination of sediments to levels exceeding the Lower Duwamish Waterway sediment cleanup goals and the Sediment Management Standards (WAC 173-204). Existing administrative and legal authorities will be used to perform inspections and require necessary source control actions.

The strategy is being implemented through the development of a series of detailed, area-specific Action Plans that will be coordinated with sediment cleanups, beginning with the Early Action Areas (EAAs). Each Action Plan will document what is known about the area, the potential sources of recontamination, actions taken to address them, and how to determine when adequate source control is achieved for an area. Because the scope of source control for each site will vary, it will be necessary to adapt each plan to the specific situation at that site. The success of

this strategy depends on the coordination and cooperation of all public agencies with responsibility for source control in the Lower Duwamish Waterway area, as well as prompt compliance by the businesses that must make necessary changes to control releases from their properties.

The focus of the strategy is on controlling contamination that affects Lower Duwamish Waterway sediments. It is based on the principles of source control for sediment sites described in EPA's *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites; EPA, February 12, 2002* (EPA 2002), and Ecology's Sediment Management Standards (WAC 173-204). The first principle is to control sources early, starting with identifying all ongoing sources of contaminants to the site. EPA's Record of Decision (ROD) for the site will require that sources of sediment contamination to the entire site be evaluated, investigated, and controlled as necessary. Dividing source control work into specific Action Plans and prioritizing those plans to coordinate with sediment cleanups will address the guidance and regulations and will be consistent with the selected remedial actions in the EPA ROD.

Source control priorities are divided into four tiers. Tier One consists of source control actions associated with the EAAs identified to date. Tier Two consists of source control actions associated with any final, long-term sediment cleanup actions identified through the Phase 2 RI and the EPA ROD. Tier Three consists of source identification and potential source control actions in areas of the waterway that are not identified for cleanup, but where source control may be needed to prevent future contamination. Tier Four consists of control work identified by post-cleanup sediment monitoring (Ecology 2004). This document is a Tier One Source Control Action Plan for an early action sediment cleanup.

Further information about the Lower Duwamish Waterway Source Control Strategy can be found at: http://www.ecy.wa.gov/biblio/0409052.html and http://www.ecy.wa.gov/programs/tcp/sites/lower_duwamish/lower_duwamish_hp.html

1.4 Source Control Work Group

The primary public agencies responsible for source control for the Lower Duwamish Waterway are Ecology, the City of Seattle, King County, Port of Seattle, City of Tukwila, and EPA.

In order to coordinate among these agencies, Ecology formed the Source Control Work Group (SCWG) in January 2002. The purpose of the SCWG is to share information, discuss strategy, actively participate in developing Action Plans, jointly implement source control measures, and share progress reports on source control activities for the Lower Duwamish Waterway area. The monthly SCWG meetings are chaired by Ecology. All final decisions on source control actions and completeness will be made by Ecology, in consultation with EPA, as outlined in the April 2004 Ecology/EPA Lower Duwamish Waterway Memorandum of Understanding (EPA and Ecology 2004).

Because the City of Tukwila and the Port of Seattle have no jurisdiction over the areas that drain to the Slip 4 EAA, they are not included in this Action Plan. Other public agencies with relevant source control responsibilities include the Washington State Department of Transportation, Puget

Sound Clean Air Agency, and the Seattle/King County Department of Public Health. These agencies have been invited to participate as appropriate (Ecology 2004).

2.0 Slip 4 Early Action Area

The City of Seattle and King County are planning a sediment removal action for early cleanup of contaminated sediments in the Slip 4 Early Action Area (EAA). Sediments in Slip 4 have accumulated chemical contaminants from numerous sources, both historical and potentially ongoing. These chemicals entered the slip through direct discharges, inadvertent spills, bank erosion, groundwater discharges, surface water runoff, atmospheric deposition, or other non-point discharges.

Slip 4 is located on the east bank of the Lower Duwamish Waterway, approximately 2.8 miles from the mouth of the Duwamish River at Elliott Bay. The slip is approximately 1,400 feet long, with an average width of 200 feet, and encompasses about 6.4 acres (Integral 2005a). Properties immediately adjacent to Slip 4 are currently owned by Crowley Marine Services, First South Properties, King County, and The Boeing Company. Crowley owns the majority of the submerged land within the Slip 4 EAA.

Slip 4 is relatively shallow, ranging from +5.0 feet mean lower low water (MLLW) at the head of the slip to approximately –20 feet MLLW at the mouth. The shallowest depths occur at the head and along the southeastern shoreline where the bottom gradually slopes to the current and historical dredging boundary located approximately halfway across the slip. At low tide, bottom sediments are exposed at the head and along the southeastern shoreline. In areas of historical dredging along the northern shoreline and in the eastern half of the slip, water depths range from –5 to –13 feet MLLW. In 1996, Crowley dredged a portion of the slip to a uniform depth of –17 feet MLLW (PTI 1995).

Sediments in Slip 4 have accumulated chemical contaminants from numerous sources, both historical and potentially ongoing. These chemicals entered the slip through direct discharges, inadvertent spills, bank erosion, groundwater seepage, surface water runoff, atmospheric deposition, or other non-point discharges.

The proposed removal area identified in the Engineering Evaluation/Cost Analysis (EE/CA) for Slip 4 includes the inner (eastern) half of the slip (Integral 2005a; Figure 3). This includes all areas where surface sediments have chemical concentrations greater than the sediment quality standards (SQS) except for one isolated station with minor SQS exceedances. Sediments outside the proposed removal area will continue to be evaluated by the LDWG, EPA, and Ecology pursuant to the Lower Duwamish Waterway (LDW) RI/FS.

2.1 Chemicals of Concern

Numerous environmental investigations have included the collection of sediment data in Slip 4. Four sediment investigations were conducted between 1990 and 1999 in Slip 4, including an EPA site investigation (Weston 1999a), a National Oceanic and Atmospheric Administration (NOAA) sediment characterization of the Duwamish River (NOAA 1998), a site assessment (Landau 1990), and a dredged material characterization (Exponent 1998). Additional sediment characterization data were collected in 2004 (Integral 2004), including surface and subsurface sediment samples and bank samples. Sediment data are detailed in *Summary of Existing*

Information and Identification of Data Gaps (SEA 2004) and *Engineering Evaluation/Cost Analysis* (EE/CA; Draft; Integral 2005a).

Chemical data are compared to the Washington State Sediment Management Standards (SMS), which include both the Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSLs) (WAC 173-204). Sediments that meet the SQS criteria have a low likelihood of adverse effects on sediment-dwelling biological resources. However, an exceedance of the SQS numerical criteria does not necessarily indicate adverse effects or toxicity, and the degree of SQS exceedance does not correspond to the level of sediment toxicity. The CSL is defined as the maximum allowed chemical concentration and level of biological effects permissible at a cleanup site to be achieved by year 10 after cleanup has been completed. The CSL is greater than or equal to the SQS and represents a higher level of risk to benthic organisms than SQS levels. The SQS and CSL values provide a basis for identifying sediments that may pose a risk to some ecological receptors. The SMS for organic chemicals are based on total organic carbon (TOC)-normalized concentrations.

As detailed in the Slip 4 EE/CA (Integral 2005a), surveys conducted between 1990 and 1999 included collection of surface sediment samples at 41 sampling locations and subsurface sediment cores (up to 10 feet deep) at 12 locations in Slip 4. The data from these samples (detailed in SEA 2004) indicate that polychlorinated biphenyls (PCBs) are the contaminant of primary concern in Slip 4 surface sediments due to their areal extent and concentration. PCBs exceeded the SQS at nearly all surface sampling locations, and exceeded the CSL at over half of the surface sampling locations. The highest PCB concentrations were found at the head of the slip, with concentrations decreasing toward the mouth.

Other chemicals exceeding the SQS or CSL in surface sediments included metals and polynuclear aromatic hydrocarbons (PAHs) in samples located in the vicinity of the outfalls at the head of the slip. Bis(2-ethylhexyl)phthalate (BEHP) exceeded the SQS and the CSL at some stations.

In subsurface sediments, PCBs were also the contaminant with the most frequent SQS exceedances. Only two other chemicals (acenaphthene and fluoranthene) exceeded the SQS in subsurface sediments.

Additional sediment samples were collected in 2004; these included surface sediment samples at 29 locations and sediment cores (to a depth of 12 feet) at 11 locations. In addition, one intertidal sample was collected along the eastern shore of Slip 4, and bank samples were collected at six locations. PCB concentrations in the 2004 surface sediment samples exceeded the SQS at six stations. CSL exceedances were confined to three stations at the head of the slip and the intertidal area located along the eastern bank of the slip. Total PCBs at the remaining 20 surface sediment stations were below the SQS.

PCBs in subsurface sediment exceeded the CSL in six of the nine cores that were submitted for chemical analysis (two cores were archived), with exceedances most commonly occurring to a depth of 4 to 6 feet.

A subset of 2004 samples were analyzed for other SMS analytes. Chemicals other than PCBs were detected at concentrations greater than the SQS in only one surface sampling location;

PCBs also exceeded the SQS at this location. At Station SG16, BEHP and phenol (in addition to PCBs) were slightly above the SQS in surface sediments. Other detected chemicals that exceeded the SQS or CSL in subsurface sediment included mercury and silver. Other than PCBs, there were no detected organic chemicals in subsurface sediment samples that exceeded the SQS or CSL (Integral 2004).

When the surface PCB concentrations from 2004 are compared with historical data collected between 1990 and 1998, it is apparent that PCB concentrations in surface sediments in many areas of the slip are lower in 2004 than they were between 1990 and 1998. In all cases, total PCBs in the surface sample are lower than the concentrations in the top interval (0 to 2 feet) of the collocated core (Integral 2005a).

The sediment chemistry data are discussed in more detail in the Slip 4 EE/CA (Integral 2005a). Source control efforts will encompass these as well as any other chemicals that could result in sediment recontamination.

Further information about Slip 4 can be found at:
http://yosemite.epa.gov/R10/CLEANUP.NSF/ldw/slip+4

3.0 Potential Sources of Sediment Recontamination

Sediments in Slip 4 contain chemical contaminants from numerous historical and potentially ongoing sources. These chemicals entered the slip through direct discharges, inadvertent spills, bank erosion, groundwater discharges, surface water runoff, spills, and other non-point discharges. This section discusses current and historical land uses and the results of environmental investigations on properties adjacent to or discharging to the slip.

3.1 Piped Outfalls

The Lower Duwamish Waterway area is served by a combination of storm drain, sanitary sewer, and combined sewer systems. Storm drains convey stormwater runoff collected from streets, parking lots, roof drains, and residential, commercial, and industrial properties to the waterway. In the Lower Duwamish Waterway, there are both public and private storm drain systems. Most of the waterfront properties are served by privately owned systems that discharge directly to the waterway. The other upland areas are served by a combination of private and publicly owned systems.

Storm drains entering the Lower Duwamish Waterway carry runoff generated by rain and snow. A wide range of chemicals may become dissolved or suspended in runoff as rainwater contacts and flows over the land. Impervious surfaces may accumulate particulates, dust, oil, asphalt, rust, rubber, metals, pesticides, detergents, or other materials because of urban activities. These are flushed into storm drains during wet weather. Storm drains can also convey materials from businesses with permitted discharges (i.e., NPDES industrial stormwater permits), vehicle washing, runoff from landscaped areas, erosion of contaminated soil, groundwater infiltration, and materials illegally dumped into the system.

Prior to formation of the Municipality of Metropolitan Seattle (Metro, now part of King County) in 1958, Seattle and other surrounding communities operated small treatment plants that discharged to Lake Washington, the Duwamish River, and Puget Sound. One of these treatment plants, the Diagonal treatment plant, located at Diagonal Ave. S. and E. Marginal Way S., was constructed in about 1939. The Duwamish interceptor, which conveyed stormwater and municipal/industrial wastewater along E. Marginal Way S. to the treatment plant, was constructed in about 1940 (Brown and Caldwell 1958). A pump station, equipped with a 36-inch emergency overflow and stormwater bypass t the head of Slip 4, was included as part of this system.

The current sanitary sewer system collects municipal and industrial wastewater from throughout the Lower Duwamish Waterway area and conveys it to the West Point wastewater treatment plant where it is treated before being discharged to Puget Sound. The smaller trunk sewer lines, which collect wastewater from individual properties, are owned and operated by the individual municipalities (e.g., Cities of Seattle and Tukwila) and local sewer districts. The large interceptor system that collects wastewater from the trunk lines is owned and operated by King County. The Elliott Bay Interceptor was constructed along the east side of the Duwamish River and Elliott Bay in 1964 to convey wastewater to the West Point plant.

Pump stations lift sewage to a location where it can continue to flow downhill to the treatment plant. If there is an equipment or power failure, an overflow route is needed to protect conveyance pipes and pumps from damage. These are called emergency overflows and only occur in the event of a serious system malfunction such as a pump failure or a blocked pipe. Pump stations are equipped with an emergency generator to ensure operation during power failures.

Some areas of the Lower Duwamish Waterway are also served by combined sewer systems, which carry both stormwater and municipal/industrial wastewater in a single pipe. These systems were generally constructed before about 1970 because it was less expensive to install a single system rather than separate storm and sanitary systems.

During large storm events, the volume of stormwater can sometimes exceed the capacity of the combined sewer system. The collection system designed for the West Point treatment plant contains relief points called combined sewer overflows (CSOs) to control the amount of combined sewage and storm water that could enter the system and especially the Elliott Bay Interceptor. The CSOs prevent the combined system from backing up and creating flooding problems. During large storm events, these CSOs release a mixture of stormwater and sanitary sewage to the waterway. There are no CSOs in Slip 4.

Potential sources that may contribute pollutants to these outfalls include:

- Chemicals carried by stormwater runoff (e.g., street dust, atmospheric deposition, automobile emissions, fertilizers, household pesticides, etc.)
- Industrial and municipal wastewater discharged during emergency overflow conditions at sewer system pump stations (known as lift station emergency overflows, or LSEOs)
- Contaminated groundwater that may have infiltrated into the system through breaks in conveyance lines
- Materials improperly disposed of in the storm drain and/or combined/sanitary systems

There are five public and numerous private outfalls in Slip 4 (Figure 4). The public outfalls are listed below:

- King County Airport SD #3/LSEO(44) – 60 inches; previously called Slip 4 SD
- North Boeing Field SD – 24 inches; previously called Slip 4 EOF/SD (117)
- I-5 SD – 72 inches
- Georgetown flume
- E. Marginal Way LSEO – 36 inches

The combined sewer service area in the Slip 4 basin encompasses about 6,200 acres and the storm drain basin covers about 467 acres (Figure 5). Land use in the basin is primarily industrial and commercial, with a small amount of residential property east of I-5. There are currently no storm-related combined sewer overflows that discharge to Slip 4. The City and King County both maintain emergency overflows (EOFs) on pump stations that discharge to Slip 4, but overflows occur infrequently.

City and County source control activities focus on reducing the amount of chemicals discharged to publicly-owned storm drains and sanitary/combined sewers through business inspections and source identification/tracing activities. Because there are no CSOs into Slip 4 and pump station EOFs occur infrequently, source control activities have focused on stormwater discharges. The City and County provide progress reports to Ecology and EPA every 6 months. Detailed information is available in the June 2004, January 2005, and June 2005 reports (SPU and King County 2004, 2005a,b).

The small private outfalls that discharge to Slip 4 serve approximately 50 acres of mostly industrial and commercial land adjacent to the slip. Non-point discharges to Slip 4 include stormwater runoff that is not collected in a piped system and discharges directly to the slip as sheet flow.

3.1.1 I-5 Storm Drain Outfall

The I-5 drain collects runoff from approximately 1.5 miles of I-5 (75 acres), 44 acres of single family residential property located east of I-5, and 1 to 2 acres on the north end of the King County airport.

3.1.2 King County Airport SD #3/LSEO(44)

The 60-inch King County Airport SD #3/LSEO(44) is owned by King County. This line drains the northern portion of the King County Municipal Airport and encompasses 290 acres of the Slip 4 drainage area. The airport drainage system has been modified numerous times. In about 1985, runoff from approximately 120 acres at the north end of the airport that formerly discharged to the 24-inch North Boeing Field SD and 1.5 acres that formerly discharged to the Georgetown flume was diverted to the 60-inch King County Airport SD #3/LSEO(44) (SEA 2004).

The emergency overflow from City pump station #44 was also diverted from the 24-inch North Boeing Field SD to the King County Airport SD #3/LSEO(44). Consequently the King County Airport SD#3/LSEO(44) now functions as a City emergency pump station overflow. City pump station #44 has not overflowed in the past 5 years (when the City started maintaining pump station records) (Schmoyer 2004).

Metro asked Boeing to provide information about a number of oil/water separators (OWS) at North Boeing Field that were identified during an August 14 year? inspection as possibly discharging to the storm drain. Of particular concern was the Building 3-315 drum storage/oil separator facility which appeared to collect drainage from drums of various fuels, oils, and solvents, as well as an electrical transformer/capacitor station (Lampe 1985). Boeing has indicated that these units do not discharge to the storm drain (Boeing 2005d).

A North Boeing Field industrial water discharge survey in 1994 discovered that process water and condensate water (including pump leaks to floor drains and condensate from room heaters and process heat exchangers) were discharging to the King County Airport SD #3/LSEO(44) (Babich 1994).

On June 11, 2004, King County staff observed white foam discharging in pulses from one of the storm drains at the head of Slip 4, later identified as King County Airport SD #3. King County Industrial Waste found that Boeing had been conducting an annual fire test at its propulsion engineering laboratory. The foam was an aqueous film-forming foam released when a valve was inadvertently left open by a new fire inspector conducting the testing. Boeing estimated that less than 3 gallons of foam were discharged into the storm system with up to 300 gallons of water. Surface water samples collected in Slip 4 contained bis(2-ethylhexyl)phthalate (BEHP) at 0.609 µg/L, and low levels of barium, boron, calcium, iron, magnesium, and sodium. Except for BEHP, the discharge contained no chemicals of concern. Boeing has modified its procedures to prevent recurrence. Reference?

3.1.3 North Boeing Field SD

The 24-inch North Boeing Field SD now drains about 1 acre on the north end of the King County International Airport (KCIA) and no longer functions as an emergency pump station overflow. Until about 1976, this system was referred to as the Greeley Street sewer and functioned as a raw sewage outfall for the far north end of the King County Airport/Boeing Field and parts of Georgetown. It was separated in 1976 and converted to a storm drain. At that time, the drain collected runoff from about 120 acres on the north end of the airport and also functioned as an emergency overflow for City sewer pump station #44, located on Airport Way S. Pump station #44 is currently connected to the King County Airport SD#3 and has not overflowed in the past 5 years, when the City began maintaining pump station records.

3.1.4 E. Marginal LSEO

King County's E. Marginal LSEO pump station is equipped with auxiliary power and would function only if the conveyance pipes became clogged or during an extreme emergency such as a simultaneous power and generator failure. There has not been a recorded overflow from this pump station since recordkeeping began in the 1970s.

In January 2005, Emerald Services reported that flow from a manhole downstream of this pump station was entering their property and discharging to Slip 4 (Smith 2005). An investigation determined that the interceptor downstream of the E. Marginal Way Pump Station was at capacity. The surcharge was backing up and coming out of a manhole at the force main discharge structure. It appeared that most of the surcharge was contained within the parking area at the pump station (Hulsizer 2005, pers. comm., Zimmer 2005, pers. comm.). At the time of this report, Emerald Services stated they had occasionally observed similar incidents, but they did not provide specific dates.

Because discharges from the combined sewer service area are infrequent, source control work in Slip 4 is focused on the separated drainage system.

3.1.5 Georgetown Steam Plant Flume

The Georgetown flume was originally constructed to discharge cooling water from the Georgetown Steam Plant (GTSP) after the river was straightened in 1916 into the Duwamish

Waterway. The 6.5-foot-wide flume is located on property owned by the City of Seattle that varies between 20 and 45 feet in width. The flume consists of concrete and wooden sections, as well as piped sections, and extends approximately 2,500 feet across the north end of the King County Airport from the GTSP to the head of Slip 4 (Figure 6).

The head or upstream end of the flume (referred to as the tunnel section) is a closed pipe that extends a distance of approximately 250 feet from the Steam Plant to a 90-foot long section of open, concrete-lined flume. The concrete-lined flume connects to twin 42-inch diameter pipes approximately 400 feet long. These pipes are connected to a short section of open, concrete-lined flume, which in turn is connected to an open wooden flume that extends to E. Marginal Way S. This open portion is approximately 1,240 feet long and meets a concrete header at the edge of E. Marginal Way S. From here, it is corrugated steel pipe that passes under E. Marginal Way S. to the outfall at the head of Slip 4.

Except for annual test runs, routine cooling water discharges were discontinued in the 1960s when the steam plant was shut down (SEA 2004). At one time, the flume was a conduit for industrial wastewater discharges and runoff from an estimated 11.5 acres of the north end of the airport. The flume now receives stormwater runoff from an estimated 10 acres.

City-owned property adjacent to the flume has been leased to Boeing. As industrial development occurred in the area, discharge pipes from nearby properties and facilities were connected to the flume at numerous locations along its length. These included both permitted and unpermitted connections for stormwater, cooling water, and industrial wastewater discharges. Some documented examples of connections and uses of the flume are discussed in Appendix A.

Sections of the flume remain uncovered and continue to collect stormwater discharge from rainwater falling in the flume and runoff from adjacent upland areas. In addition to Boeing, adjacent upland properties without direct connections to the flume but with possible overland runoff include storage areas, the Willow Street substation, and a former substation site (Ellis Street). Boeing uses paved areas near S. Myrtle Street to stage materials and equipment.

SPU has used an undeveloped area (west of the flume and north of S. Myrtle Street) to stage stockpiles of gravel, sand, and mixed soil and asphalt (Bridgewater Group 2000). Surface soil samples collected at the SPU yard contained PCBs at 1.2 mg/kg and less than 1 mg/kg near the center of the property (Bridgewater Group 2000). (The Washington State Model Toxics Control Act [MTCA] Method A soil cleanup level for unrestricted use is 1 mg/kg PCBs.) In 2001, the City installed an underground vault and regraded/bermed the storage area to contain runoff onsite. Site runoff is currently collected in an underground vault. The vault is periodically pumped to remove stormwater and silt. Material is disposed offsite. The City intends to close this storage area in 2006.

The Willow Street Substation is unpaved and slopes toward the flume. During a site visit in 2000, Bridgewater Group (2000) observed no staining or other evidence of release around the perimeter of the substation or between the substation and the flume. The former Ellis Substation, located on the east side of the flume, just south of S. Myrtle Street, was decommissioned in 1990. A composite soil sample consisting of 10 subsamples, collected between the substation and the flume in 1984, contained 0.071 mg/kg PCBs (Raven 1991). Additional samples were collected in 1991 from onsite soil and concrete equipment pads. PCBs were detected in two of

the three soil samples (<0.1 to 0.5 ppm Aroclor 1254) and one of the four concrete samples (<0.1 to 0.2 ppm Aroclor 1254). Is this also from Raven 1991? – need to check Bridgewater report

3.2 Spills

The U.S. Coast Guard and Ecology were contacted regarding information on oil or chemical spills to Slip 4 (SEA 2003a, 2003b). Records prior to the 1990s at both agencies are not centralized and consist primarily of individual incident reports. No other reports of spills from facilities adjacent to Slip 4 were found during a review of Ecology files. The U.S. Coast Guard provided information of spills on record occurring in the Duwamish River from 1992 to 2003, but, based on available information, none appear to have occurred in the vicinity of Slip 4 (USCG 2003).

3.3 Properties Adjacent to Slip 4

In addition to discharges via the outfalls described above, adjacent properties may contribute contamination to Slip 4 through contaminated groundwater discharging directly to the slip or infiltrating into a stormwater system that discharges to the slip. Another potential source of contamination is soil erosion from the riverbank. If chemicals of concern from an adjacent site reach the waterway, they could recontaminate the Slip 4 sediments.

Properties adjacent to Slip 4 are currently owned by: Crowley Marine Services (Crowley), First South Properties, King County, and The Boeing Company (Boeing Plant 2) (Figure 7). These are discussed in Section 3.3.1 through 3.3.4 below.

The banks of Slip 4 are armored by a sheet-piling wall with rip rap along the northwest (Crowley) shoreline and by riprap along the Boeing Plant 2 shoreline. Portions of the shoreline along the northeast Crowley shoreline, First South Properties parcel, and the head of the slip are lined with discontinuous segments of wooden or cinderblock bulkheads or are only partially armored with pavement debris such as concrete, asphalt, and brick or coarse gravel and cobbles.

The wooden bulkhead along the southwestern shoreline of the First South Properties is estimated from aerial photos to be approximately 50 years old. Erosion of the slope along this bulkhead has been observed. Other evidence of bank erosion includes a minor amount of eroded vegetation observed on the Crowley shoreline and a small drainage gully from the upland portion of First South Properties to the slip (Integral 2005a).

In September 2004, six soil samples were collected from various locations along the banks of Slip 4 by the City of Seattle. Five of these samples, BK02 through BK06, were collected from the banks of the First South/Emerald Services property. The banks and this portion of the slip are owned by Crowley. BK06 is located near the junction of the property lines of First South Properties, Crowley and Boeing Plant 2. The samples were collected from the intertidal zone at elevations of approximately 10 feet above MLLW. The data found sample BK06 exceeded the CSL for PCBs.

Additional bank sampling was conducted in 2005 by Ecology (Parametrix 2005) and Boeing (Bach 2005a, as cited in Integral 2005a). The purpose of the Ecology Slip 4 bank upland soil

and sediment sampling activity was to determine the extent of the problem. Bank surface and subsurface soil/sediment sample results showed that some PCB concentrations exceed the SQS and/or the CSL. Removal of these sediments during the cleanup will eliminate this recontamination source. Ecology will work with the City of Seattle and EPA to address the surface and subsurface bank soil/sediment PCB contamination as part of the sediment cleanup in Slip 4 (Ecology 2005).

3.3.1 Crowley Marine Services

Crowley Marine Services (Crowley) owns the property on the northwest side of the slip. Previous tenants include Northland Services (Northland) and Samson Tug and Barge Company, Inc. (Samson). The site is currently leased to Alaska Logistics. The upland area is used for cargo container storage, and a berthing facility occupies the northwestern shoreline of the slip. Most of the facility is paved, with only the area adjacent to E. Marginal Way S. remaining unpaved. Some minor vehicle maintenance occurs on the site. Equipment and vehicles being transported occasionally leak oils and other fluids. During a recent inspection, spill control materials were available onsite, but no spill response plan was available. Reference? The facility does not have an industrial stormwater NPDES permit or a SWPPP. Alaska Logistics and Crowley have been notified that they need to apply for a NPDES permit.

Current Storm Drainage

Surface drainage for this property discharges to six 8-inch outfalls located along the north side of Slip 4 (Figure 8) (Northland 2002). During a joint SPU/Ecology inspection of the Crowley property in June 2004, a sediment sample was collected from one of the onsite catch basins. The catch basin contained zinc (1,220 mg/kg DW) at levels above the SQS. PCBs were not detected at 20 ug/kg DW and BEHP was measured at 1,600 ug/kg DW, but did not exceed the SQS when the data were TOC-normalized.

Past Use

The Crowley property (Tax Parcel 2136200641) is made up of two parcels, as shown on Figure 7. Parcel D was the southern two-thirds and Parcel F formed the northern one-third of the Crowley property (SEA 2004). Past uses of these two parcels are summarized in Appendix A.

Environmental Sampling/Cleanup

Parcel D. Several investigations to assess conditions resulting from past site uses have been conducted at Parcel D (SEA 2004). Soil samples collected in 1988 through 1990 detected arsenic (up to 2,800 mg/kg), TPH (up to 29,000 mg/kg), carcinogenic PAHs (cPAH; up to 1,396 mg/kg), and PCBs (up to 2.5 mg/kg) were detected in soil above cleanup levels. The elevated arsenic appeared to be localized in the vicinity of a former pole-dipping facility. Hart Crowser estimated that approximately 9,000 cubic yards of soil exceeded cleanup levels (Hart Crowser 1989a). Monitoring wells installed and sampled during 1988 through 1990 detected arsenic, copper, and cPAHs above surface water quality criteria (SEA 2004).

Additional information about environmental sampling at Parcel D is provided in Appendix A. There is no record of soil or groundwater remediation on Parcel D.

Parcel F. Several investigations to assess conditions resulting from past site use have been conducted at Parcel F (SEA 2004). Soil samples collected in 1989 and 1990 detected several contaminants including PCBs, but only TPH was detected above MTCA cleanup levels (Hart Crowser 1989b). In groundwater samples, copper and BEHP were detected above surface water quality criteria (Hart Crowser 1989b, 1991). PCBs were not detected in groundwater.

Additional information about environmental sampling at Parcel F is provided in Appendix A. Except for the removal of two underground storage tanks, there are no records of soil or groundwater remediation on Parcel F.

Potential for Future Releases to Slip 4

Spills at the property may enter the storm drain system and be discharged to Slip 4 through the outfalls located on the north side of the slip or via sheet flow. The facility does not have a stormwater permit or SWPPP.

Available soil and groundwater data indicate arsenic, TPH, cPAHs, and PCBs are present in soil at concentrations greater than MTCA Method A industrial cleanup levels, and arsenic, copper, cPAHs, and BEHP are present in groundwater at concentrations greater than surface water quality criteria. The property is paved, except for the area adjacent to E. Marginal Way S., reducing the likelihood of soil being carried into the slip by stormwater.

Groundwater near the slip does not exceed surface water criteria; however, groundwater from other portions of the property where contaminant concentrations exceed surface water criteria may reach the Duwamish. The historical groundwater data should be reexamined to evaluate the potential for contaminated groundwater to reach Slip 4.

3.3.2 First South Properties

First South Properties is the owner of the land northeast of Slip 4 (Figure 7; also called Parcel E). The property is currently occupied by Emerald Services and is being used to store portable toilets, storage tanks and containers, dumpsters, and large construction hauling/recycling containers. The property is partially paved. There is an office trailer and one small building used for equipment storage located along the southern fence line with Boeing. Ecology and SPU inspections in late 2005 and January 2006 found that the transfer of the NPDES permit from prior tenant Cedar Grove Composting to Emerald Services was invalid. Emerald Services has a SWPPP and conducts the inspections and monitoring required by the NPDES Industrial Stormwater General Permit. Emerald Services is working to submit a new application for coverage.

An inspection of the facility by SPU and Ecology on January 18, 2006 found that Emerald Services needs to clean the catch basins and oil/water separator, and should address some localized oily sheens on the ground (reference). There does not appear to be any significant flow to the slip.

Current Storm Drainage

Five 4- to 6-inch outfalls are located on the southeast side of Slip 4 between about 700 and 1,000 feet from the mouth of the slip. Three of the outfalls, two piped and one ditch, serve the western portion of the property (Figure 9). The function of the other two pipes is unknown. The eastern portion of the site drains to the King County interceptor located on E. Marginal Way S., which discharged to the King County Metro Wastewater Treatment Plant at West Point.

Past Use

The site was previously occupied by Washington Machinery and Storage Company and J.A. Jack & Son Lime Plant and Northwest Precote. These past uses are summarized in Appendix A.

Environmental Sampling/Cleanup

The following information is from a site summary prepared by SEA (2004). Additional information on environmental sampling conducted at this property is provided in Appendix A.

Several investigations were conducted from 1988 through 1996 to assess site conditions at this parcel. The initial investigation identified chemical contamination in soils. A number of cleanup actions followed, including soil removal and groundwater monitoring. Ecology ultimately determined that no further action was required at this property.

Following a preliminary groundwater and subsurface soil investigation performed at the parcel by Hart Crowser in March 1989, Landau conducted a more extensive investigation in June 1990 in the vicinity of two USTs (Hart Crowser 1991; Landau 1990). Most locations sampled during the Landau investigation were excavated during later remedial activities (Hart Crowser 1991, 1996). In the locations not included in the remediation, the maximum detected TPH concentration of 2,600 mg/kg exceeded the MTCA Method A soil cleanup level for industrial properties; detection limits for cPAHs were above MTCA cleanup levels of 2,000 µg/kg. The maximum concentrations of cadmium, chromium, and lead were slightly above Method A soil cleanup levels. No PCBs were detected in the soil samples (Landau 1990).

Maximum concentrations of arsenic, copper, and zinc detected in groundwater samples exceeded surface water quality criteria for dissolved metals; detected concentrations of VOCs and LPAHs were below surface water quality criteria for human consumption of aquatic organisms. No TPH or PCBs were detected in the groundwater samples (Landau 1990).

In 1991, five USTs were excavated and removed from the site, and four additional monitoring wells were installed, and 22 test pits were excavated (Hart Crowser 1991). Approximately 1,500 cubic yards of visibly stained soil and rubble associated with the USTs were excavated from the site and disposed of at permitted offsite facilities (Hart Crowser 1991). Concentrations of TPH in the test pits ranged from less than 10 to 25,000 mg/kg, above the MTCA Method A cleanup level of 2,000 mg/kg. Hart Crowser (1991) attributed these concentrations to the use of oil for dust control and roadway stabilization.

Groundwater was sampled in October 1990, January 1991, and April 1991 from four monitoring wells. Analytical results indicated decreasing concentrations of TPHs and LPAHs and no detected VOC or cPAH concentrations. Hart Crowser (1991) analyzed the maximum constituent

concentrations detected in groundwater to evaluate potential impacts to Slip 4. They compared all groundwater concentrations from the UST excavation area to calculated worst-case criteria based on MTCA surface water protection and sediment quality criteria. They did not consider attenuation, dispersion, or dilution during transport. Hart Crowser determined that TPH and 2-methylnaphthalene concentrations in groundwater exceeded the worst-case criteria. One former well sample exceeded the criterion for 2-methylnapthalene. TPH concentrations were declining and 2-methylnaphthalene in the downgradient well nearest Slip 4 was below the worst-case criterion (Hart Crowser 1991).

Evergreen Marine Leasing applied to Ecology for a No Further Action (NFA) determination for the site in the fall of 1994. Ecology determined that further remedial action was required (Marten & Brown 1997). Beginning in 1996, more TPH-contaminated soil was removed based on Ecology's recommendations (Marten & Brown 1997; Hart Crowser 1996). Ecology issued a NFA determination for the TPH-diesel release in 1997. The NFA was conditioned on conducting groundwater monitoring for TPH and filing of a Restrictive Covenant for the site (Ecology 1997). Monitoring documented compliance with the NFA and monitoring was terminated by Ecology in 1998 (Ecology 1998).

In November 2005, sediment samples were collected from an oil/water separator located at the southwest corner of the property, the drainage ditch at the northwest corner of the property, and two catch basins on the southeast corner of the property (one on S. Webster Street) that drain to the combined sewer on E. Marginal Way S. Sampling stations are shown on Figure 10, and results are provided in Tables 1 and 2. Sediment in the oil/water separator contained elevated concentrations of zinc (758 mg/kg DW), BEHP (120,000 ug/kg DW, 1.869 mg/kg OC), and di-n-octylphthalate (4,000 mg/kg DW, 62 mg/kg OC). Zinc and di-n-octylphthalate exceeded the SQS, and BEHP exceeded the CSL. Sediment in the ditch (5,500 ug/kg DW, 177 mg/kg OC) also exceeded the CSL for BEHP. Of the two catch basins that drain to the combined sewer, the onsite catch basin contained elevated concentrations of BEHP (38,000 ug/kg DW, 1,418 mg/kg OC), butylbenzylphthalate (1,800 ug/kg DW, 67 mg/kg OC), dimethylphthalate (1,900 ug/kg DW, 71 mg/kg OC), and di-n-octylphthalate (1,800 ug/kg DW, 67 mg/kg OC). The catch basin on S. Webster Street did not contain contaminants above SQS or MTCA cleanup levels.

Potential for Future Releases to Slip 4

Spills at the property may enter the storm drain system and be discharged to the slip through the outfalls on the southeast side of the slip or via overland flow. Although the facility has an industrial stormwater permit, it apparently does not have a SWPPP. Two additional pipes apparently discharge into the slip from unidentified sources.

Available soil and groundwater data from upland areas of the property indicate that TPH, cPAHs, cadmium, and lead may be present in soil at concentrations above the MTCA Method A industrial soil cleanup level. Arsenic, copper, zinc, and 2-methylnaphthalene may be present in groundwater at concentrations greater than surface water criteria at the property. The historical groundwater data should be reexamined to evaluate groundwater as a source of recontamination. Available sediment data do not indicate that groundwater is a current source of contamination.

If contaminated soil is present in unpaved areas of the property, contaminants may enter the slip through soil transport in stormwater.

3.3.3 King County

King County owns a small property and building northeast of First South Properties on East Marginal Way South. The building is a pump station associated with the Elliott Bay Interceptor. The pump station was built in 1966 and has operated since that time. There is an emergency overflow from the pump station to Slip 4.

Storm Drains

There is no information on drainage from this parcel.

Past Use

No specific information was found to address this specific parcel. Given its location, it was likely used as part of the Washington Machinery and Storage Company operations.

Environmental Sampling/Cleanup

No environmental sampling or cleanups are known to have occurred at this site.

Potential for Future Releases to Slip 4

Given the small size of the parcel and the nature of operations at the facility, this property does not appear to be a potential source of recontamination.

3.3.4 Boeing Plant 2

The entire Boeing Plant 2 facility occupies 109 acres between E. Marginal Way S. and the Duwamish River on the southeastern side of Slip 4. About 17.5 acres of this property drains to Slip 4 (Figure 11). The facility is used for storage as well as for the manufacturing of metal parts for airplanes (Weston 1998). Building 2-122 is located adjacent to Slip 4 and was built in the early 1990s to house the Integrated Aircraft Systems Laboratory (Boeing 1993). The facility is used to test sensor systems developed by Boeing. The site is paved with small landscaped areas.The grounds between the parking area and Slip 4 include public walking trails and trees. A single-family residence is located on Webster Street northeast of Building 2-122 (Weston 1998). Boeing Plant 2 building numbers and locations are shown on Figure 12.

Current Storm Drains

Two 30-inch storm drains are located on the south side of the slip approximately 170 feet from the mouth. These collect parking area stormwater and roof drainage for about 17.5 acres of Boeing Company property. Boeing has an Industrial Generator Stormwater Permit (#SO3000482D) for Plant 2, which became effective September 2002. The facility has a Stormwater Pollution Prevention Plan (SWPPP). The plan includes a facility description, potential pollutant source inventory, and best management practices (BMPs). Both drains are covered under the facility's industrial stormwater permit and are managed under the facility SWPPP.

Past Use

Boeing has manufactured airplane parts at Plant 2 since 1936 (SEA 2004). Past use is summarized in Appendix A.

Environmental Sampling/Cleanup

There have been a number of investigations at the north end of Boeing Plant 2 from 1990 through 1994 to assess conditions resulting from past site uses and to document soil removal and cleanup actions (SEA 2004). These include:

- Phase II Subsurface Environmental Assessment, Proposed Integrated Aircraft Systems Laboratory Building, Seattle, Washington (Weston, October 1990)
- Supporting Documentation for Engineer's Certification of Closure, Boeing Plant II, 2-01 Building Dangerous Waste Sump (CH2M Hill, December 1991)
- Leaking Underground Storage Tank Investigation, Proposed Integrated Aircraft System Laboratory Construction Site, Plant II, Seattle, Washington (Weston, January 1992)
- Release Assessment, Boeing—Plant 2, Seattle/Tukwila, Washington (Weston, March 1994)

In 1990 Weston performed a preconstruction environmental assessment of soil and groundwater around the perimeter of the former Building 2-01, which was located at the north end of Plant 2 adjacent to Slip 4 to the north and the Duwamish Waterway to the west. Four soil borings and three push-probe groundwater stations were located along the north side of the former building along the shoreline of Slip 4. One composite surface soil sample collected adjacent to electrical transformers near the southeast corner of the former Building 2-01 contained 14 mg/kg PCBs (Weston 1990). This exceeds the MTCA Method A soil cleanup level of 10 ppm.

In subsurface soil, several VOCs were detected at concentrations below MTCA cleanup levels. PAHs were detected in subsurface soil at individual concentrations ranging from 71 to 28,000 µg/kg. Only naphthalene and several cPAHs in a sample located in the parking lot south of the former Buildign 2-01 exceeded MTCA cleanup levels. PCBs were not detected in any of the subsurface soil samples. TPHs were detected in two subsurface soil samples at concentrations below MTCA cleanup levels. Cadmium was present above the MTCA cleanup level in one sample (Weston 1990). Remediation in these areas was completed as part of the 2-122 building construction. Need reference from Boeing

Vinyl chloride at 2.0 µg/L was the only VOC detected in groundwater. This is below the water quality criterion for human consumption of aquatic organisms (530 µg/L). Chromium (up to 11 mg/L), copper (2.7 mg/L), lead (0.7 mg/L), nickel (3.8 mg/L), and zinc (2.4 mg/L) were the only metals detected in groundwater. All of these metals were detected in one or more samples at concentrations that exceeded their respective marine chronic water quality criteria. However, because the groundwater samples collected using push-probe sampling methods were typically turbid, metals concentrations were not considered representative of ambient metals

concentrations in groundwater. Oil and grease were detected in several groundwater samples at concentrations ranging from 0.8 to 12 mg/L (Weston 1990).

The dangerous waste sump (a RCRA Treatment, Storage, or Disposal unit) in the former Building 2-01 was removed and closed in 1991 (CH2M Hill 1991). PCBs were not analyzed during closure activities. Following demolition of Building 2-01, the sump was demolished, and 343 tons of concrete and associated soil were disposed of at the hazardous waste landfill in Arlington, Oregon. An additional 270 tons of soil were excavated and disposed of at Arlington during three additional rounds of sampling and excavation. Ecology approved interim status closure of the former Building 2-01 dangerous waste sump in July 1992 (Sellick 1992). The closure of the sump is not referred to as "final closure," since other dangerous waste management units remain in operation at Plant 2 (CH2M Hill 1991).

Boeing performed a Release Assessment under an Administrative Order on Consent for a 3008(h) RCRA corrective action (Weston 1994). The assessment included an evaluation of groundwater quality data from the north end of Plant 2 in the vicinity of Slip 4, but did not include an evaluation of soil chemical data from this area. In addition to the analytical results for the push-probe groundwater samples collected from the perimeter of the former Building 2-01, the Release Assessment included data from three monitoring wells that were temporarily installed in the parking lot east of the building in the area now occupied by Building 2-122. The full suite of groundwater analytes is not known. Arsenic (up to 30 mg/L) and chromium (up to 60 mg/L) were detected in unfiltered groundwater samples collected from the wells (Weston 1994). The maximum detected metals concentrations exceeded their respective marine chronic water quality criteria.

A leaking UST was removed in 1991 from an area just outside of the southeast corner of the former Building 2-01 (Weston 1992). A total of 541 tons of petroleum-contaminated soil was removed from the vicinity of the former UST. The maximum soil TPH concentration measured from the removed material was 16,000 mg/kg of TPH. Following soil removal, the bottom of the excavation contained soil with a TPH concentration of 420 mg/kg of diesel. Additional soil was not removed due to the presence of 1 to 2 feet of groundwater in the excavation bottom. One soil sample from the excavation was also analyzed for PCBs; no PCBs were detected. There is no information in Ecology files that TPH impacts to groundwater were subsequently investigated (SEA 2004).

Additional information on environmental sampling and cleanup is provided in Appendix A.

Recent Actions

Boeing is currently conducting a RCRA corrective action investigation at Plant 2. All of the RCRA corrective action investigation units are located south of Building 2-122 and do not include the redeveloped north end adjacent to Slip 4, since this north end area was extensively remediated as part of Building 2-122 construction. The corrective action includes sediments in the Duwamish west of Plant 2, known as the Duwamish Sediment Other Area (DSOA), but does not include sediments in Slip 4.

Potential for Future Releases to Slip 4

Spills at the north portion of the property (near Building 2-122) may enter the storm drain system and be discharged into the slip; however, activities that might cause releases are controlled in accordance with an industrial stormwater permit and SWPPP, and stormwater runoff flows through bioswales prior to discharge. The potential for spills from this area to reach the slip is small.

Available data indicate that remediation has been completed and the property is paved; therefore, the likelihood for contaminated soil to be carried by stormwater into the slip is small. The original groundwater data from various studies needs to be reevaluated. More current groundwater data may be needed to assess this area as a potential groundwater source to the slip, although sediment data do not suggest that there are impacts from groundwater.

3.4 Upland Properties

Other upland sites may contribute contamination to Slip 4 through stormwater and other discharges to piped outfalls and through contaminated groundwater infiltrating into a stormwater system that discharges to the slip. If chemicals of concern from an upland site reach the waterway, they could recontaminate the sediments.

Upland properties not directly adjacent to Slip 4 include: the Georgetown Steam Plant, North Boeing Field, the King County International Airport, and a Washington Air National Guard site. These are discussed below.

The GTSP, owned by Seattle City Light, is included because the facility once discharged cooling water to Slip 4 and has been identified as a potential source of contamination of the slip. North Boeing Field is discussed because of past releases at the site and recent information that it may be a potential source of recontamination. The Washington Air National Guard site, which is adjacent to the Georgetown Steam Plant Flume, is a contaminated site currently undergoing cleanup.

Although the former Sternoff Metals is a contaminated site with PCBs in soil and groundwater, onsite drainage from this facility is to a combined sewer. Drainage around the property likely discharges to storm drains along 8th Ave. S. and is released outside the Slip 4 drainage basin. This will be confirmed during subsequent source identification activities.

Upland soil samples collected in 2005 detected PCBs in several soil borings. (Parametrix 2005). The PCB concentrations for all soil borings were well below the MTCA Method A criteria for industrial properties (10 ppm dry weight [DW]). There was no evidence of non-aqueous phase liquid (NAPL) plumes or other indications that the PCBs found at depth pose a threat of recontamination (Parametrix 2005).

3.4.1 Georgetown Steam Plant

The Seattle City Light GTSP property is located on the northwest corner of King County Airport/Boeing Field . The property contains the old powerhouse, which currently

houses the Georgetown Power Plant Museum. The condenser pit in the powerhouse is connected to the GTSP flume and, until the 1960s, discharged cooling water from the steam plant to the flume.

Current Storm Drainage

There are currently no storm drains present at the GTSP. Stormwater at the GTSP infiltrates into the ground or flows into catch basins at North Being Field, to the south or west.

Past Use

The powerhouse was built in 1906 by Seattle Electric Light Company. It contained three turbo-generators: a 3,000 kW unit, an 8,000 kW unit, and a 10,000 kW unit installed, in 1907, 1908, and 1917, respectively (Bridgewater Group 2000). When the plant was constructed, it was located along an oxbow of the Duwamish River. Past use of this site is summarized in Appendix A; Figure 13 identifies features of the site.

Environmental Sampling/Cleanup

A number of environmental investigations have been conducted at the GTSP. Areas of chemical contamination were identified on the property, in sediments of the flume, and Boeing storm drains connected to the flume. Contaminated soils and sediments have been removed from the site and flume in the past. Sediments in the flume were monitored for a number of years and sampling conducted in 1998 and 2002 indicated that no further action was required (SEA 2004). Samples collected by SPU in 2005 found PCBs in sediment; the city is working to identify and control the source. Additional information on environmental sampling and cleanup is provided in Appendix A.

Oil samples collected by Seattle City Light in 1980 from three oil feed USTs located adjacent to the southwest corner of the Steam Plant were analyzed for PCBs. Results showed 10, 7, and 20 ppm respectively, in Tanks 1, 2, and 3. Soil samples collected at depths ranging from 0 to 15 inches and 120 to 126 inches did not show PCBs at a detection limit of 1 ppm (Bridgewater Group 2000).

In 1982, EPA investigations found metals, PAHs, and PCBs in Duwamish waterway sediments in Slip 4 (Raven Systems & Research 1988). Sampling by Metro confirmed the presence of PCBs in the flume and in a Boeing storm drain (SEA 2004). Samples collected in 1984 confirmed PCB in soils on a low-lying area of the GTSP property, ranging from less than 0.1 to 91,000 mg/kg (SEA 2004). PCBs were also found in a drainage ditch leading from the northern part of King County Airport (0.2 to 8.9 mg/kg) and in adjacent areas of the airport and Boeing-leased property under paved areas (190 to 223 mg/kg). Reference.

Overflow from the low-lying area flowed into the storm drain system at North Boeing Field (Raven 1988). King County worked to divert surface runoff from the airport in order to minimize flow into the ditch. Low-lying areas of the GTSP property were covered with plastic (SEA 2004). During 1985, Seattle City Light performed a cleanup of the unpaved low-lying areas. Contaminated soils and sediments were removed and unpermitted connections into the flume

were sealed. Subsequent sampling of the cleaned areas indicated that PCB concentrations were reduced to 11 mg/kg or less (SEA 2004).

In 1985, Ecology performed a preliminary site assessment and Boeing North Field and the Georgetown Steam Plant were identified as a potential source of PCBs, lead, and petroleum products.

After the cleanup and the sealing of unpermitted drains, the flume continued to operate as a point of discharge for two permitted cooling water discharges from Boeing facilities. Overflow from low-lying areas at GTSP continued to enter the flume through a Boeing storm drain to the head of the flume (Raven 1988).

In 1986, Seattle City Light collected additional samples from the drainage and flume were collected by Seattle City Light. PCBs as Aroclor 1254 were detected in drainage ditch sediments at concentrations ranging from 4 to 15 mg/kg and in flume samples ranging from 1 to 123 mg/kg. The highest concentration was downstream of where the discharge tunnel connects to the flume. Based on the renewed detection of PCBs, Boeing was notified by Seattle City Light of the need to terminate the two permitted cooling water connections to the flume. Samples collected in 1988 between the head of the flume and S. Myrtle Street showed concentrations of Aroclor ranging from 0.25 to 14.26 mg/kg with highest concentrations found again at the head of the flume (Bridgewater Group 2000).

From 1989 to 1991, Seattle City Light continued to test the flume for PCBs. PCB concentrations ranged from 1.6 to 103 mg/kg, with Aroclor 1254 being the predominant mixture of PCBs detected. During most monitoring events, PCB concentrations decreased with distance from the GTSP (Bridgewater Group 2000, Raven Services Corporation 1989–1991).

Seattle City Light collected water and oil samples from the GTSP underground water tank in 1987. This tank was located south of the large, concrete Bunker C fuel tank. There were no PCBs above laboratory detection limits; however, oil & grease was detected in one sample at 20 mg/L. Copper and zinc were detected at 0.036 and 0.047 mg/L respectively in another sample. After emptying the tank, analysis showed the sludges in the tank had PCBs as Aroclor 1260 at concentrations ranging from 1.3 to 2 ppm (Bridgewater Group 2000).

Other investigations in areas originally part of the GTS property have found significantly elevated concentrations of PCBs. Investigations conducted by Boeing in preparation for construction of Building 3-333, near the original location of the flume, found PCBs in soil samples up to 4,150 mg/kg (Seacor 1996). Remedial actions taken to facilitate construction of the building included soil removal and confirmation sampling. AGI (1998a) reported that PCB and TPH were below MTCA Method A cleanup levels on three sides of the building; however, elevated levels remained on the fourth side of the building. These areas were reported to be isolated and no further action was taken (SEA 2004, AGI 1998a). Total petroleum hydrocarbons (TPH) were found in samples as diesel and gasoline at concentrations of 7,600 and 7,800 mg/kg respectively (Bridgewater Group 2000).

During 1988 and 1989, three feed oil USTs that formerly supplied oil to the boilers of the steam plant, a large concrete oil tank northeast of the site, and the steam plant diesel tank were all removed. No PCBs were found in soil samples collected when these tanks were removed (SEA

2004, Bridgewater Group 2000). A series of soil samples from these locations were also tested for petroleum hydrocarbons. Oil and grease, thin layer chromatography (TLC) polynuclear aromatics (PNAs), and TLC hydrocarbons were detected at 3,660, 200, and 250 ppm respectively in one soil sample collected at a depth of 14 feet near the large concrete storage tank. Another sample in this area had 60,000 ppm of TLC PNAs at a depth of 21 feet. Oil and grease were detected in a 0- to 1.2-foot-deep sample collected near the north feed oil UST at a concentration of 35,690 ppm. TPH concentrations in samples from the excavation of the three feed oil USTs ranged from 8.6 to 67,600 mg/kg (Bridgewater Group 2000).

In 1989, Seattle City Light collected soil, water, and surface wipe samples at the pump house located north of Slip 4 on the Duwamish Waterway that supplied water to the Steam Plant. None of these samples showed PCBs at levels above the detection limits (Raven Services Corporation 1989–1991, Bridgewater Group 2000).

The Ellis substation, located adjacent to the flume near S. Myrtle Street, was decommissioned by Seattle City Light the following year, and in November of 1990 Seattle City Light sampled two transformer tap chargers. PCBs were detected at concentrations of 12.1 and 9.2 ppm. The four concrete and four soil samples detected Aroclor 1254 in one of the concrete samples at 0.2 mg/kg and in two of the soil samples at 0.1 and 0.5 mg/kg.

In September 1999 the GTSP site was added to Ecology's list of confirmed and suspected sites. Ecology and Public Health-Seattle & King County conducted a site hazard assessment at GTSP in 2001. The site was assigned a Washington Ranking Method ranking of 5 out of 5.

In 2001, the Bridgewater Group conducted a Phase II environmental assessment of the GTSP on behalf of Seattle City Light. Wipe samples were taken at multiple locations in the building beneath electrical equipment and beneath an oil pump. No PCBs were found in the samples except in one sample where Aroclor 1248 was detected at 1.1 $\mu g/100cm^2$ (SEA 2004). Forty soil samples were collected from the property and analyzed for TPH-Dx, PCBs, PAHs, and heavy metals. All of the results for PCBs, PAHs, and metals were below the MTCA method A cleanup levels. One sample collected near an old oil tank contained diesel at 4,200 ppm and heavy oil at 2,200 ppm (cleanup levels are at 2,000 ppm).

During November 2005, Boeing collected soil samples from the gaps in the retaining wall along the fence line between the GTSP and NBF. The highest PCB concentration in these soil samples was 2,400 mg/kg (Boeing 2005e).

In January 2006, Seattle City Light collected additional soil samples from this same area. The data should be available by March 2006 (Goldberg 2006).

Potential for Future Releases to Slip 4

Spills at the GTSP are likely to infiltrate into the site soil. Contaminated soil may be transported by stormwater to catch basins at NBF and discharged into Slip 4. There are currently no known uses of chemicals at the GTSP; therefore, the potential for spills from this area to reach the slip is small.

Available soil data indicate that PCBs are present in soil at GTSP at concentrations greater than MTCA Method A industrial soil cleanup levels. The property is unpaved and stormwater apprently flows into catch basins and subsequently to the slip.

This property is a likely future source of contaminants to the slip.

3.4.2 North Boeing Field

North Boeing Field (NBF) is leased by Boeing from King County Airport. The 130-acre site is located between E. Marginal Way S. to the west and King County Airport to the east. Ellis Avenue S. forms the northern border, as does the Federal Aviation Administration Tower for the southern extent of the site. The head of Slip 4 is approximately 150 feet from the northwestern boundary of NBF. Nearly all of the stormwater discharge from the NBF site is through the King County lift station to King County Airport SD#3 at the head of Slip 4.

The entire area within the NBF property boundaries is developed. Land use at the site includes office and industrial buildings, aircraft parking and related facilities. The remaining portion of the site is almost entirely paved. Automobile parking areas comprise approximately 36 acres, while flight line positions and taxiways comprise approximately 42 acres. Less than 1 percent of the site is pervious, including landscaped areas adjacent to some of the buildings.

Primary activities at the site include aircraft finishing and testing; research and development of Boeing military and commercial aircraft; and support services. Aircraft finishing activities involve wet sanding, cleaning, and painting of airplanes. Testing of airplane parts, both assembled and unassembled, occurs throughout the site.

Research and development groups at NBF have separate specialized testing operations. Support operations include metalworking, woodworking, and a wastewater treatment plant.

The northeast portion of North Boeing Field was part of the GTSP prior to lease of the property by Boeing.

Current Site Drainage

Boeing has an Industrial General Stormwater Permit (#S03000226C) for NBF, which became effective September 2002. The latest revision of the NBF Stormwater Pollution Prevention Plan (SWPPP) submitted to Ecology (a requirement of the permit) is dated September 2001. The plan includes a facility description, potential pollutant source inventory, and best management practices (BMPs). Under the permit, annual dry weather inspections are performed to identify unpermitted non-stormwater discharges, such as domestic wastewater, non-contact cooling water, or process wastewater. Quarterly discharge visual inspections and discharge monitoring are performed to look for evidence of pollution in the storm drain system, and to ensure that BMPs are being implemented.

Drainage patterns at NBF are generally defined by the slopes of paved areas, building locations, and the storm drainage system. The storm drainage system consists of a network of catch basins, manholes, and pipes ranging from 8 inches to 48 inches diameter. There are 23 drainage areas at

this site. Nine of these cover approximately 41 acres that do not discharge to Slip 4. NBF drainage is shown on Figure 14.

Drainage from NBF commingles with runoff from the King County Airport. Storm sewer conduits from approximately 171 acres of King County Airport enter the site from the east at four locations, as described in Section 3.4.3.

Drainage from the Air National Guard buildings, the King County Airport Maintenance Shop, and parts of King County Airport located west, north, and northeast of the Seattle City Light building enters the NBF site near the 3-325 building through a 24-inch line.

The northern end of the airport, including the north ends of the runways; a portion of northeastern King County Airport; and the hangars located adjacent to East Perimeter Road drain onto the NBF system near stall A-6 on the flight line. This drainage area includes a King County Airport fuel station.

Drainage from approximately 190 feet of the north end of the 13R-13L runway, and the small airplane parking areas and hangars adjacent to the East Perimeter Road connect to the NBF storm drainage system near stall B-8 on the flight line.

About 750 feet of runway 13R-13L; 900 feet of runway I3L-31R; east taxiway areas and loading aprons; and the terminal, north annex, and administration buildings discharge into the NBF site storm drainage system stall B-11 on the flight line.

Potential Industrial Pollutant Sources

Activities occur at NBF in the seven industrial activities cited in the General Permit for inclusion in the SWPPP. All of these activities occur in one or more of the site drainage basins. These activities are indicated on the site maps in Appendix D of the SWPPP, which is currently being updated.

Loading and Unloading

Except for bulk liquid material, there are several authorized areas for the loading and unloading of both hazardous and non-hazardous new materials that are received from offsite. Spent hazardous and non-hazardous materials are shipped off site. Bulk liquid material is delivered by the vendor directly to the holding tanks. Most of these areas represent a potential source of pollutants as there are only a few covered and permanently contained loading and unloading areas. With a history of only a few spills, the transfer practices provide good protection.

Outdoor Storage

There are 13 storage stations that contain hazardous or liquid chemical materials that could come into contact with stormwater at NBF. The storage area descriptions, locations, and materials lists are described in the SWPPP. Outside material areas, other than aboveground or underground storage tanks, are roofed and are equipped with secondary containment. Tank storage areas comply with all regulatory requirements, including secondary containment and fail-safe controls.

The Central Dangerous Waste Accumulation Area (CDWAA) is located in Building 3-3 13 and is used for less than 90-day accumulation of dangerous waste from satellite areas within the plant. The CDWAA is roofed and the loading area is covered. Dangerous waste is segregated by waste type in separate dedicated accumulation cells. Floors in each cell are sloped to separate dead end sumps.

Container accumulation areas are located at the 3-369 Building (Paint Hangar), 3-822 Building (Fuel Farm), 3-354 Building (Hydraulic Shop), and the 7-027 Building (North Yard). Mobile carts are located on the flight line service aprons. Container accumulation areas are roofed or have stormwater protection such as berms or plastic tarping. Hazardous material storage areas have secondary containment.

Airplane and fuselage sections are temporarily stored within Drainage Basin K. Temporary storage locations include the area adjacent to Building 3-369 (Paint Hangar). Transportation personnel and hazardous waste handlers are trained on standard operating procedures for proper handling and packaging of hazardous materials and hazardous waste, M non-bulk new material is stored indoors, either in the receiving areas, enclosed storage sheds, or in the using shops. Stockpile areas are covered with tarps or plastic.

Industrial activities such as engine component testing, aircraft painting, and research and development activities take place inside buildings or within contained areas.

All of the aboveground waste storage tanks are provided with secondary containment and are inspected daily. These tanks are equipped with overfill alarms (visual and/or audible), interstitial detection systems, and most are electrically connected to the site emergency monitoring and control system. The rest of the tanks (underground and aboveground) are inspected weekly. The adjacent storm drains either have emergency shut-off valves or drain covers. The potential pollution risks associated with these operations are posed by vendors that deliver products to or remove wastes from these tanks and do not follow the instructions posted at the tanks for drain coverage, or leave the tanker unattended during operations.

Outdoor Manufacturing Processes

Outdoor manufacturing processes consist of fueling and defueling aircraft, deicing at the wash stall (C-13), and performing engine preflight and avionics testing. Minor processes consist of cosmetic work such as touch-up painting, chemical cleaning, and interior work. Potential pollutants from the outdoor manufacturing processes that are susceptible to stormwater runoff are fats, oils, grease, and organics.

Surfaces Exposed to Air Emissions

Approximately 12 percent of the impervious surface at NBF is rooftops. The Annual Puget Sound Clean Air Agency Emissions Statement provides emission estimates and sources of air emission contaminants at NBF. The significant sources are the paint hangars, paint booths, and shops located in Building 3-818.

Onsite Treatment, Storage, and Disposal

At NBF, there is a wastewater pretreatment system that is used to treat process wastewaters and other treatable hazardous waste. Stormwater drainage from the treatment plant, including the loading area, is processed through the treatment plant and discharged to the sanitary sewer.

Vehicle/Equipment Washing and Steam Cleaning

Aircraft de-icing, large vehicle and equipment washing occurs at the C-13 Wash Stall. The wash stall discharges to the sanitary sewer unless it is determined that the water would fail the King County Department of Natural Resources discharge standards.

There is a protected wash area at the 3-354 Building, which is located adjacent to the automotive maintenance shop for vehicle and equipment steam cleaning. The wastewater pumped into Above Ground Tank ABF-160 is regularly shipped to an approved hazardous waste facility for proper disposal.

A fuel truck maintenance and washing area is located on a specially constructed concrete pad at the south side of Building 3-822. The water passes through an oil-water separator before discharging into the sanitary sewer.

The North Boeing Field NPDES Industrial Wastewater Discharge Permit was terminated in December 1995.

Environmental Sampling/Cleanup

There have been numerous investigations and cleanups on the NBF property. Much of the work is the result of environmental investigations done prior to new construction or facility modification. The following is a list of reports filed with the Department of Ecology. There may be other reports that have been archived or filed under other facility names that are not on this list.

- Field and Laboratory Services Utilidor Project North Boeing Field (Groundwater Technology 1990a)
- Soil Sampling and Analyses Inlet Development Facility (Groundwater Technology 1990b)
- Supplemental Pre-Construction Environmental Investigation Proposed 3-801 Building Site (Seacor 1991)
- Building 3-354 Preconstruction Environmental Assessment (Groundwater Technology 1991a)
- Preconstruction Environmental Assessment Building 3-840 Expansion (Groundwater Technology 1991b)
- Pre-Construction Environmental Investigation Proposed 7-027-1/2/3 and 3-360/361/365 Building Sites (Seacor 1992a)

- Independent Cleanup Action report, Flight Line Utilities Project Concourse C (Seacor 1992b)
- Site Assessment Main Fuel Farm (Seacor 1992e)
- Soil and Groundwater Investigation, Fire Training Center - North Boeing Field (Landau 1992a)
- Cleanup Action Program North Boeing Field Fire Training Center, King County Airport (Landau 1992b)
- Independent Soil Remedial Action Report, Flight Test Engineering Laboratory 3-801 Building Location (Seacor 1992c)
- Site Assessment Investigation 3-800 Building (Seacor 1992d)
- North Boeing Field Storm Drain System PCB sampling (Landau 1993a)
- Storm Drain System Cleanout North Boeing Field (Landau 1993b)
- Report of Permanent Closure Former Underground Storage Tank near Fire training Center (Landau 1993c)
- Remedial Action North Boeing Field Fire Training Center, King County Airport (Landau 1993d)
- Pre-Closure Site Assessment Investigation F&G Facility (Seacor 1994a)
- Supplemental Site Assessment Investigation Green Hornet Area (Seacor 1994b)
- Independent Soil Remedial Action Green Hornet Area (Seacor 1994c)
- Report For UST Decommissioning Site Assessment And Monitoring Well Abandonment F&G Facility (Seacor 1994d)
- Site Assessment And Independent Soil Cleanup Action During the Decommissioning of an Oil/Water Separator, Main Fuel Farm, North Boeing Field (Seacor 1994e)
- Site Assessment During The Decommissioning Of Underground Storage Tanks BF-22 and BF-23, 3-374 Building (Seacor 1994f)
- Independent Soil Cleanup Action Report Proposed 3-333 Building Location (Seacor 1996)
- Remedial Action Report, Proposed West Wing 3-333 Building Fuel Test Laboratory (AGI 1998b)
- Site Investigation Oil/Water Separator UBF-55 (AGI 1998c)

Oil/Water Separator UBF-55

In 1997, AGI Technologies (AGI) conducted a site investigation for the OWS designated as UBF-55. This OWS was located in the northwest portion of North Boeing Field on property that Boeing leases from King County. The area is bounded to the north by the Georgetown Steam Plant and a gas meter, to the west by the air-gas dryer area, and to the southeast by the 3-326 Building.

The OWS was installed in 1976 and was constructed of steel with a 5,000-gallon capacity. An adjacent 3,000-gallon fuel oil underground storage tank (UBF-27) was removed in May 1986. Analytical results of soil samples collected during verification sampling of the UBF-27 indicated the presence of PCBs, PCB-1248, and PCB-l254 at concentrations above cleanup levels (AGI 1998c).

Maximum TPH (gasoline, diesel, and motor oil range) concentrations were detected in samples collected from the lower sampling intervals (4.1–7.1 feet bgs) of two borings. Maximum gasoline, diesel, and motor oil concentrations detected were 150, 1,900, and 550 mg/kg, respectively. Of the 18 lower interval samples, five exceeded 1997 cleanup levels. One sample contained gasoline-range petroleum hydrocarbons at a concentration above the current MTCA Method A soil cleanup level.

Maximum PCB concentrations were detected in samples collected from north and south of the OWS. Analytical results indicate maximum PCB concentrations in soil collected from the upper and lower sampling intervals were 260 and 1,540 mg/kg, respectively. Of the 18 lower interval samples analyzed, six exceeded cleanup levels. Two of the four upper interval samples analyzed exceeded cleanup levels. No operational source for this PCB contamination has been identified; it may be the result of a historical release.

Joint Caulk Removal

In a survey of concrete joint caulk conducted in 2001, Boeing identified 57,900 linear feet of primary caulk, or residual caulking material from prior removals, that contained PCBs. Boeing has been removing caulk containing PCBs from the North Field area that drains to Slip 4 under EPA oversight since 2002 (Boeing 2005f). Caulk that was removed had concentrations of PCBs up to 79,000 parts per million (7.9 percent PCBs). There is approximately 1,400 linear feet of residual joint sealant material left to be removed at NBF, most of which is located between Stall C-3 and Stall C-4. Removal of this material is expected to be completed in 2006 (Boeing 2005d).

Include citations to info from Dan Duncan, etc.(?)

Sediment Trap and Inline Sediment Samples

In March 2005, SPU installed seven in-line sediment traps on Boeing-leased property (in cooperation with The Boeing Company) and two traps upstream of the Boeing-leased property in the Slip 4 storm drain system that serves North Boeing Field, as well as one trap in the I-5 storm drain (Figure 14). Traps are installed for a four- to six-month period to passively collect samples of suspended sediment present in the stormwater runoff. Boeing is responsible for recovering samples from seven of the traps, and SPU maintains the remaining three traps. The first sediment samples from the traps were recovered in August 2005. Results are provided in Tables 1 and 2. The next round of sediment traps are scheduled to be recovered in February/March 2006.

All samples on Boeing-leased property contained PCBs. The levels ranged from 0.1 to 24 ppm DW (Aroclors 1254 and/or 1260). Because of low sample volumes, total organic carbon (TOC) analysis was performed on only one of the traps; PCBs in this sample (233 mg/kg OC at SL4-T1)

exceeded the CSL. Dry weight concentrations in four of the five samples exceeded the MTCA Method A soil cleanup level for industrial use (10 mg/kg DW).

In addition to PCBs, mercury (0.86 to 1.2 mg/kg DW) and zinc (220 to 553 mg/kg DW) in the five sediment traps on Boeing-leased property were also present in concentrations that exceed the Sediment Management Standards. Bis(2-ethylhexyl)phthalate (BEHP) concentrations ranged from 2,400 to 6,000 ug/kg DW and exceeded the SQS in the one sample (SL4-T1) where sufficient sample volume was available to analyze TOC (56 mg/kg OC).

Samples collected from the four traps in the King County Airport SD #3/LSEO(44) located upstream of the Boeing-leased property generally contained lower concentrations of contaminants. PCB concentrations in the upstream traps ranged from 0.039 to 0.45 ppm DW (Aroclors 1254 and 1260). One of the two samples tested for metals exceeded the SQS for zinc (220 to 460 mg/kg DW). No other metals exceeded the SQS in the upstream samples. BEHP concentrations exceeded the SQS in the one sample (SL4-T4A) where sufficient sample volume was available to analyze TOC (49 mg/kg OC).

The sample from the sediment trap on the I-5 storm drain contained concentrations of zinc (422 mg/kg DW) exceeding the SQS. In addition, BEHP (189 mg/kg OC) and PCBs (246 mg/kg OC) also exceeded the CSL.

In February 2005, SPU also collected samples from accumulated sediment present in three of the maintenance holes where the traps are deployed (MH363/SL4-T5, MH221A/SL4-T4, and MH229A/SL4-T4A) and one maintenance hole located near the downstream end of the Georgetown flume (MH100). Inline samples are grab samples collected from sediment that has deposited in the storm drain line, typically at maintenance holes or other areas where sediment accumulates. All samples were split with Boeing. Inline sediment data are provided in Tables 3 and 4. Sampling locations are shown on Figure 13. PCB concentrations were elevated in all of the inline sediment samples (1 to 31 mg/kg). Sample splits were variable, but with the exception of sample MH229A/SL4-T4A (0.31 to 5.6 mg/kg DW), the inline sediment samples were comparable and were fairly consistent with the sediment trap results. Mercury (0.09 to 0.7 mg/kg DW) and/or zinc (208 to 1,130 mg/kg DW) were also elevated in the inline samples. In addition, three LPAH and four HPAH compounds exceeded the SQS in the sample collected from MH229 (SL4-T4A). BEHP concentrations (57 to 76 mg/kg OC) exceeded the SQS in three of the four samples (MH221A, MH363, and MH229A).

2005 Catch Basin Samples

Boeing has conducted extensive sampling of solids from storm drain structures including catch basins, manhole access locations, and oil/water separators throughout the Boeing-leased property. During May and June 2005, 13 of these storm drain structures were sampled for PCBs. Twelve of these structures were identified for sampling due ot elevated PCB detections discovered during prior sampling events. Sample results for the 12 structures from July and August 1991 to August 2000 had PCB detections ranging from 17 to 342 ppm (Boein g2005b). Results from May and June 2005 ranged from 3.5 to 50 ppm DW (Landau 2005).

During September 2005 through November 2005, Boeing conducted an investigation to determine the sourceof PCBs in the north storm drain line where PCBs were detected in the

sediment at 24 ppm DW. Samples were obtained from nine catch basins and PCBs were detected from 0.07 ppm to 1,310 ppm DW (Boeing 2005c). Most of the samples contained a mixture of Aroclors 1254 and 1260. However, a few of the samples also contained Aroclors 1242 and 1248 (Boeing 2005e).

In order to determine whether potential infiltration of PCB-contaminated soil is entering the storm drains from breaks or gaps in the piping system in the vicinity of the catch basin with 1,310 ppm DW PCB (old OWS UBF-55), Boeing removed accumulated sediment from the lines leading to this catch basin and conducted a video inspection. The system appeared to be in good condition with no visual gaps or breaks in the piping. The line was last cleaned in 1992 (Boeing 2005e). Need a map to show where UBF55 is located relative to drain lines and which drain lines were cleaned.

In November 2005, Boeing collected soil samples from the gaps in the concrete retaining wall that parallels the storm drain line and the fence line between the Georgetown Steam Plant and NBF. Concentrations were highest in the six samples collected along the southeast end of the property (5.1 to 2,400 mg/kg DW). PCB concentrations in the soil samples collected just south of the Steam Plant building were generally below 1 mg/kg DW. PCBs in these soils were predominantly Aroclor 1254. Boeing believes that this soil may be the source of the elevated PCBs in the NBF north end storm drain line (Boeing 2005e).

Potential for Future Releases to Slip 4

Spills at North Boeing Field may enter the storm drain system and be discharged to the slip. However, activities that could potentially cause spills are controlled by the facility industrial stormwater permit and SWPPP.

Available soil and groundwater data indicate PCBs are present in soil at concentrations above the MTCA Method A industrial cleanup level. However, the facility is almost entirely paved, making transport of subsurface3 contaminated soil into the storm drain system unlikely, except in the northeast corner where contaminated soil from the GTSP may be entering catch basins at North Boeing Field. Seattle City Light collected additional soil samples from this area in late January 2006 (Goldberg 2006).

PCBs are also present in residual joint sealant material in one area of the facility. This residual material is planned for removal in 2006.

Storm drain sediment traps and catch basin samples indicate the presence of PCBs in the storm drain system. Storm drains at the property are a likely future source of PCBs to the slip unless the origin of PCBs in the storm drains is identified and controlled.

3.4.3 King County International Airport

Boeing Field (currently known as King County International Airport) was dedicated on July 26, 1928. It was named Boeing Field because of the Boeing Airplane Company's proximity and because Boeing's Pacific Air Transport (later United Airlines) used it for regular airmail service. Runway construction began on March 28, 1928, with fill from dredging the Duwamish River.

Since its dedication, it has been used for airplane manufacturing and air transportation (HistoryLink.org, 2005).

Current Site Drainage

Drainage from the Air National Guard buildings, the King County Airport Maintenance Shop, and parts of King County Airport located west, north, and northeast of the Seattle City Light building enters the NBF site near the 3-325 building through a 24-inch line.

The northern end of the airport including the north ends of the runway; a portion of northeastern King County Airport; and the hangars located adjacent to East Perimeter Road drain onto the NBF system near stall A-6 on the flight line. This drainage area includes a King County Airport fuel station.

Drainage from approximately 190 feet of the north end of the 13R-13L runway, and the small airplane parking areas and hangars adjacent to the East Perimeter Road connect to the NBF storm drainage system near stall B-8 on the flight line.

About 750 feet of runway 13R-13L; 900 feet of runway I3L—3IR; east taxiway areas and loading aprons; and the terminal, north annex, and administration buildings discharge into the NBF site storm drainage system stall B-11 on the flight line.

King County has an Industrial General Stormwater Permit (#SO3000343D) for the King County International Airport Maintenance Shop, which became effective September 2002.

Potential Industrial Pollutant Sources

Environmental Sampling/Cleanup

Potential for Future Releases to Slip 4

3.4.4 Washington Air National Guard

The Seattle Air National Guard Station (ANGS) property is located at 6736 Ellis Avenue South. The station consists of 7.5 acres and four buildings (34,698 total square feet). The property is leased from King County by the U.S. Air Force, who in turn licenses the property to the Washington State Military Department for Air National Guard use. The current mission of the 143rd Communications Squadron is to provide mobile communication support and telephone/teletype support for airports and airfields.

Seattle ANGS consists of a Communications/Administration Building, an Aerospace Ground Equipment (AGE) motor vehicle building, a paint storage building, and Mobility Storage.

Seattle ANGS activities generate waste oils, cleaning solvents, paint wastes, and thinners. In the past, small amounts of hazardous materials have been spilled or released into the environment at the station. However, during recent years, hazardous wastes have typically been collected and

disposed of by a contractor or through the Defense Reutilization and Marketing Office at Fort Lewis, Washington.

With the exception of landscaped planters around the perimeter of the site, the ground surface is entirely covered by buildings and pavement.

Storm Drains

Drainage from the north portion of the site, along with stormwater from the King County Airport Maintenance Shop and parts of King County Airport located west, north, and northeast of the Seattle City Light building, enters the NBF site near the 3-325 building through a 24-inch line. Drainage in the southern portion of the site discharges to the I-5 storm drain.

Past Use

Seattle ANGS was built during World War II by the War Department and was used by the Army Air Force as the "Aircraft Factory School" during the war. In 1948, the property was given to King County as surplus property and was subsequently leased to the Washington Air National Guard. In 1948, the station consisted of 17 acres of land, including an aircraft parking ramp, leased from King County. At that time, the property contained 15 buildings (including a number of small shed structures), all of which were subsequently demolished. No site plans or photographs depicting these buildings or the general station layout have been located.

In 1951, a new property lease decreased the size of the station from 17 acres to its present size of 7.5 acres, and buildings were constructed for headquarters, mess hall, warehouse, and vehicle service requirements. Replacement of all building was begun in 1980, and completed in 1984, with the exception of the Mobility Warehouse, which was completed in 1988.

Environmental Sampling/Cleanup

The Preliminary Assessment/Site Inspection report (OpTech 1995) noted that except for an aerial photograph of very poor resolution of the general area taken in 1940, no site plans or photographs depicting the station layout and its activities during the World War II period were found.

Solid wastes generated from the 1950s through 1968 at the Station were reportedly burned and/or buried in the northeastern comer of the site, or disposed of off site. Wastes generated during this period included radio tubes, solvents, used motor oils, kerosene, batteries, brake fluid, spray paints, and paint thinners/removers. Additionally, interviews with site workers indicate that chlorinated solvents may have been used at the Station in the 1970s and 1980s. In particular, workers recalled using solvents in the former paint shop that existed in the southern portion of the site prior to 1984 (ERM 2001). Based on the worker interviews, it is possible that small quantities of solvents leaked or spilled during storage and use. As a result of the Preliminary Assessment (PA)/Site Investigation (SI), an area approximately 175 feet long by 175 feet wide in the northeastern corner of the Station was designated as ERP Site 1 – Burial Site.

The Burial Site Air Operations Center (AOC) is located in the northeast corner of Seattle ANGS, approximately 70 feet east of Building 202, the AGE Vehicle Maintenance Building. From the

early 1950s to 1968, various waste items were burned and buried in the area northeast of the old gravel parking lot. The probable wastes associated with this site include radio tubes, solvents, waste motor oils, kerosene, batteries, brake fluid, spray paints, paint thinners and removers, MEK, xylene, and naphtha.

The Station previously had a washrack in the southern portion of the site, as well as several USTs. According to a station plan dated 1982, there were four USTs previously located at the station: a 4,000-gallon motor gasoline UST, a 2,000-gallon diesel fuel UST, a 2,000-gallon UST (contents unknown), and a fourth UST (size and contents unknown).

The former washrack and underground storage tanks were removed in the 1980s and 1990s during station remodeling and prior to the RI. A building that contained a paint shop and a battery shop also existed in the southern portion of the site; this building was demolished in the mid-1980s during Station remodeling. Finally, a waste burial site (ERP Site 1) reportedly existed in the northeastern corner of the Station from the 1950s through 1968. However, no conclusive evidence of historical waste burial or burning activity was discovered in this area during the PA/SI or RI.

The Phase II RI, conducted in 1998 and 1999, detected trichloroethene (TCE), tetrachloroethene (PCE), and benzene in shallow groundwater at concentrations above cleanup standards. Other constituents investigated in soil and groundwater (semivolatile organic compounds, TPH, radionuclides, and metals) were either not detected, were detected at concentrations below cleanup standards or were consistent with area or regional background concentrations. The TCE detected in groundwater beneath the southern portion of the Station was the only contaminant considered to present a potential risk to human health or the environment, due to its persistence at concentrations above the MTCA Method A Cleanup Level (ERM 1999). The results suggested that the groundwater contamination in the southern portion of the Station was most likely caused by minor releases or incidental spills of TCE during historical Station operations. No evidence of TCE migration beneath the site from offsite sources was identified.

There is no evidence of residual dense non-aqueous phase liquid (i.e., liquid TCE) at the site. The highest TCE concentration detected in groundwater (83 µg/L) is well below the 10,000 µg/L level considered to be indicative of potential dense non-aqueous phase liquid. Based on the distribution and monitoring of dissolved TCE, Ecology has determined that there has been no significant offsite migration, although the southern (downgradient) edge of the Seattle ANGS plume appears to overlap the northern (upgradient) edge of the Boeing Area 3-360 plume.

The groundwater treatment area is in the southern portion of the Station, and is approximately 150 feet wide and 200 feet long.

Potential for Future Releases to Slip 4

Spills at the Seattle Air National Guard Station property may enter the storm drain system and be discharged to the slip.

Available soil and groundwater data indicate that TCE, PCE, and benzene are present in groundwater at concentrations above surface water criteria. Groundwater may infiltrate into the

storm drain system and be discharged to Slip 4, however, the contaminants do not present a threat of recontamination of slip sediments.

The property is considered a possible future source of contaminants to the slip due to the potential for spills to enter the storm drain system.

3.4.5 Other Upland Contaminated Sites

Sites where there is evidence of a release of hazardous substances that may pose a threat to human health or the environment are entered into Ecology's Confirmed or Suspected Contaminated Sites (CSCS) list. Generally, these sites involve a release of chemicals from something other than an underground tank, such as a spill, material pile, waste storage, or other source.

Fourteen site names on the CSCS list are within the Slip 4 drainage basin. Add a figure. How do these relate to the sites shown in Tables 7, 8, and 9? Four have been addressed by Ecology's Voluntary Cleanup (VC) Program and three have been issued "no further action" determinations by Ecology. The Washington Air National Guard site is under an agreed order and cleanup is in progress.

There are five leaking underground storage tank (LUST) sites listed in the basins that drain to the Slip 4 cleanup site. All are listed in Ecology's database as "reported cleaned up."

The files for all of these sites will be reviewed to determine whether there are any chemicals of concern present and if the sites are a historic or potential source of sediment contamination or recontamination. Target chemicals include PCBs, mercury, phthalates, and other chemicals which may partition into or affect the sediments.

It should be noted that errors in geographic positioning data (latitude and longitude) do occur. Thus, sites may exist in the Slip 4 drainage basin that do not appear on the maps. Likewise, some of the sites on the maps may actually be located outside the source control project area. Corrections are made as Ecology becomes aware of the errors.

4.0 Source Control Actions Specific to Slip 4

This section describes source control actions to be taken to reduce the potential for recontamination of Slip 4 sediments from ongoing sources. Potential ongoing sources of sediment recontamination include: North Boeing Field, the I-5 Storm Drain outfall, the Georgetown Steam Plant flume, and storm drains on properties adjacent to Slip 4. The following sections briefly summarize the available information about chemicals from these drainage systems that discharge to Slip 4. The summary focuses on the chemicals of greatest concern for sediment recontamination at Slip 4, namely PCBs and BEHP. PCBs and BEHP are the most common problem chemicals in waterway sediment; PCBs and BEHP exceed the cleanup screening level in 64 and 45 percent of the surface sediment samples, respectively. As shown below, these two chemicals are also commonly found in the sediment samples collected from the drainage systems that discharge to Slip 4.

PCBs in source sediment samples.

	PCBs (mg/kg DW) (mg/kg OC)	Aroclor	Exceedance Frequency (percent) MTCA Method A (unrestricted use)	MTCA Method A (industrial soil)	CSL	n
Sediment traps[a]	0.038 – 24 (8.4-246)	1254, 1260	50	20	67	10
Catch basins[b]	0.066 – 1,310 (NA)	1242, 1248, 1254, 1260	91	67	NA	33
In line sediment[c]	0.31 – 31 (7-2,793)	1254, 1260	75	12	62	8
Georgetown flume[d]	0.038 – 92 (5-1,746)	1248, 1254, 1260	33	8	17	12
Catch basin and other sediment[e]	<0.02 – 0.3 (<0.4-4.7)	1254, 1260	0	0	0	5

MTCA Method A soil cleanup level for unrestricted use: 1 mg/kg DW
MTCA Method A soil cleanup level for industrial use: 10 mg/kg DW
CSL (cleanup screening level): 64 mg/kg OC

a. Traps installed by SPU in Slip 4 SD and I-5 SD
b. Catch basins sampled on North Boeing Field by Boeing in 2005.
c. Inline sediment samples (4 splits) collected in the Slip 4 SD by SPU in 2005.
d. Sediment samples from flume and 2 samples from pipe/ditch that discharge to flume
e. Catch basin and/or ditch samples from properties immediately adjacent to Slip 4.

BEHP in source sediment samples.

	BEHP (mg/kg DW)	BEHP (mg/kg OC)	Exceedance Frequency (percent) SQS	CSL	n
Sediment traps[a]	1.8-6	49-189	100	33	3
Catch basins[b]	NA	NA	NA	NA	NA
In line sediment[c]	0.18-2.2	24-76	50	0	8
Georgetown flume[d]	0.12-3.8	2-75	25	0	12
Catch basin and other sediment[e]	0.09-120	6-1,400	80	60	5

4.1 North Boeing Field—King County Airport

Sediment samples collected by Boeing, the City of Seattle, and King County (inline sediment traps, catch basin sediment, and sediment collected from maintenance holes on the storm drain system) indicate that PCB concentrations are elevated in many of the storm drains discharging to Slip 4.

The Boeing Company has been investigating potential sources of PCBs around North Boeing Field (Bach 2005c, pers. comm.) and has identified concrete joint material (caulk) present in the pavement on North Boeing Field as one potential source of PCBs in the catch basin sediments (Landau 2001). Samples of caulk material contain <1 to 79,000 mg/kg DW PCBs (primarily Aroclors 1254 and 1260, with some 1248). The highest concentrations of PCBs are generally found in three types of caulk (Type A, G, and H).

In addition, Boeing found elevated concentrations of PCBs (0.049–2,400 mg/kg DW, Aroclor 1254 and 1260) in soil samples collected along the west edge of the Georgetown Steamplant property. This area may drain to the Slip 4 SD during high intensity storm events.

BEHP concentrations in the Slip 4 inline sediment samples (180-2,200 ug/kg DW) and sediment traps (1,800–6,000 ug/kg DW) were relatively low compared to other source sediment samples collected in the Lower Duwamish Waterway (<20-26,000 ug/kg DW). However, 50 percent of the inline samples and 100 percent of the sediment trap samples that contained sufficient sample volume to analyze TOC content to allow comparisons with the SMS, exceeded the SQS. Only one sample exceeded the CSL.

4.1.1 Storm Drains

Residual sediment in storm drain structures (e.g., catch basins, inlets, maintenance holes, and other associated structures, like oil/water separators) as well as the sediment that has accumulated in the storm drain pipes that contain elevated concentrations of PCBs should be removed to prevent these materials from reaching Slip 4. Based on available data, many of the

storm drains on Boeing-lease property on North Boeing Field are contaminated with PCBs. However, it is unclear whether the contaminated sediments extend beyond the structures and into the pipes. Further evaluation is needed to determine whether the entire line needs to be pressure washed or whether simple cleaning of the associated structures will be adequate to control PCBs in these systems.

The storm drains serving the King County Airport generally contain lower concentrations of PCBs (0.038-0.45 mg/kg DW in sediment traps and 0.31-5.6 mg/kg DW) than the concentrations found on North Boeing Field. However, sampling of the King County Airport system has been limited. Further investigation is needed to determine whether catch basin cleaning and/or pressure washing of the drainage system are needed to control PCBs to Slip 4.

4.1.2 Caulk Removal

Boeing has been working to remove PCB-contaminated joint material from the paved areas on North Boeing Field. As of 2005, approximately 57,000 linear feet of caulk material has been removed (Cargill 2006, pers. comm.). An estimated 1,500 linear feet of caulk is scheduled to be removed in 2006.

Further investigation is needed to determine whether other areas on the airport contain PCB-contaminated caulk that could reach Slip 4 via nearby storm drains.

4.1.3 Source Control Actions

The following source control actions are currently underway or will be conducted:

- SPU installed in-line sediment traps across North Boeing Field and the surrounding area in February 2005. Data collected in August 2005 show PCB contamination from Georgetown Steam Plant, Georgetown Flume, I-5/residential area, and King County International Airport and Boeing-leased properties at the airport.
- SPU, Ecology, EPA, King County, and Boeing are currently evaluating all available data to identify possible source areas or activities and possible controls.
- Boeing will remove the remaining 1400 linear feet of PCB-containing caulk material from runways, under EPA TSCA supervision (end of 2006)
- Ecology's TCP, Waste and Water programs and King County/Hazardous Waste inspected North Boeing Field in November/December 2005; results are pending (March 2006).
- Ecology will conduct a comprehensive data analysis of the North Boeing Field property (April – August 2006).
- Boeing will complete a revision to the SWPPP to address PCBs in the storm drain system and to conduct inspections of the NBF facility (late 2006).

- Data from in-line sediment traps which have been re-installed for the 2005/2006 season will be available around August 2006; SPU will distribute and evaluate these data.

- Boeing and KCIA will clean drain lines and contaminated structures (end of 2006).

- SPU, Boeing, and KCIA will complete source tracing (late 2007)

- Boeing and SPU will resample sediment traps to evaluate source control effectiveness (2008).

- Ecology and EPA will evaluate NBF's NPDES permits with respect to Slip 4 sediment impacts (see Section XX below).

4.2 I-5 Storm Drain and Residential Drainage

PCB (7.8 mg/kg DW, 246 mg/kg OC) and BEHP (6 mg/kg DW, 189 mg/kg OC) concentrations in the one sediment trap sample collected to date in the I-5 storm drain exceeded the CSL. The following source control actions are currently underway or will be conducted:

- SPU will complete source tracing in the small commercial/industrial business strip along I-5 to determine if there are any obvious sources; Washington State Department of Transportation (WSDOT) will be involved as necessary (2006).

- SPU and WSDOT will clean lines and structures of contamination (2007)

- SPU and WSDOT will resample drain lines and structures of contamination for effectiveness of source control actions (2007-2008)

4.3 Georgetown Flume

PCB concentrations exceed the SMS at multiple locations along the flume, ranging from 5 to 0.038-92 mg/kg DW. Concentrations (0.78-92 mg/kg DW) are generally higher at the upper end of the flume (above S. Willow St) compared to the downstream end (0.065-0.4 mg/kg DW). The highest concentration (92 mg/kg DW/1,746 mg/kg OC) was measured in the flume adjacent to the 15-inch storm drain (P3) that entered just downstream of the tunnel section. This storm drain is now plugged. P3 contained only Aroclor 1254. Other samples generally contain a mixture of Aroclor 1254 and 1260, with some samples also containing Aroclor 1248.

PCB-contaminated sediment found by the City in the upper end of the flume in 2005 needs to be removed. In 2006, the City will evaluate options to identify the preferred alternative for removing PCB-contaminated sediment and closing the flume.

The following source control actions are currently underway or will be conducted:

- Connection toward North Boeing Field is a possible source of PCBs and both SPU and Boeing are investigation this (see Georgetown Steam Plant below) (November 2005 – March 2006)

- SPU will remove contaminated sediments (2007)
- SPU will develop alternatives to evaluate the future use and potential closure of the flume (2007 – 2008)

4.4 Georgetown Steam Plant

Historically, the pathway of contamination from the Georgetown Steam Plant to Slip 4 was the Georgetown Flume. Recent data indicate that an area along the west fenceline with NBF (soils contained behind ecology blocks and capped with asphalt) may be a source of PCBs to both the Flume and storm drain lines on NBF.

Additional investigation is needed to determine the source of the PCBs found in the soil/sediment samples collected adjacent to the west property line at the Steam Plant by Boeing in November 2005. City Light is collecting additional soil samples in January 2006 to test for the presence of PCBs in soil on the Steam Plant property. Depending on the results of these samples, additional cleanup may be necessary. The following source control actions are currently underway or will be conducted:

- SCL and Boeing will complete the soil investigation and cleanup, as needed (2006)
- SCL, Ecology, and EPA will revisit past site determinations relative to ongoing sediment contamination and SPU decisions regarding the Flume (2007)

4.5 Storm Drains on Properties Adjacent to Slip 4

None of the 5 samples collected from the drainage systems located on properties adjacent to Slip 4 that drain directly to the slip (<0.02 - 300 mg/kg DW) contain elevated concentrations of PCBs. However, all three of the drainage structures sampled on the Emerald Services property (located on the south side of Slip 4) exceed the CSL for bis(2-ethylhexyl)phthalate (177 – 1,869 mg/kg OC, 5,500 – 120,000 ug/kg DW). Di-n-octylphthalate (4,000 ug/kg DW, 62 mg/kg OC) also exceeded the SQS in the oil/water separator at the southwest corner of the property (drains to Slip 4). The catch basin located on the southeast corner of the property, which drains to the combined sewer on E Marginal Way S contained elevated concentrations of butylbenzylphthalate (1,800 ug/kg DW, 67 mg/kg OC), dimethylphthalate (1,900 ug/kg DW, 71 mg/kg OC), and di-n-octylphthalate (1,800 ug/kg DW, 67 mg/kg OC).

Residual sediment in storm drain structures (e.g., catch basins, inlets, maintenance holes, and other associated structures, like oil/water separators) as well as the sediment that has accumulated in the storm drain pipes that contain elevated concentrations of PCBs should be removed to prevent these materials from reaching Slip 4.

4.5.1 Crowley Marine (Parcels D & F)

Historic spills or contamination may be a source of contaminants to Slip 4; historic sources indicate a wood treating operation, pipe dipping, log storage, and aluminum window

manufacture were conducted at this site. Portions of the site were unpaved for much of its history, with large equipment use, soil and groundwater contamination associated with USTs at the site. The current tenant, Alaska Logistics, transfers containers for shipment to/from Alaska and was subject to joint Ecology/SPU inspections during 2005; during this site visit, outfalls and drainage destination were identified. The following source control actions are currently underway or will be conducted:

- Ecology will compile and evaluate historic water quality data (2006)
- Ecology and EPA will complete a historic use investigation to identify data gaps for recontamination potential associated with soil and groundwater (2006)
- Ecology and EPA will determine how to fill the data gaps identified above (late 2006)
- Ecology and EPA will collect effluent/runoff and in-line solids to assess recontamination potential from any ongoing sources (2006 – 2007)
- Ecology will conduct additional sampling and evaluation as necessary (2007)
- Ecology and EPA will evaluate NPDES permits with respect to Slip 4 sediment impacts (see Section XX below).

4.5.2 First South Properties (Parcel E)

Tenants at this site have included Emerald Services/Webster, Cedar Grove Composting, Evergreen Marine Leasing, an asphalt plant, and lumber/log industries. See Appendix XX for history of this parcel.

Ecology and SPU conducted joint inspections at Emerald Services throughout 2005 and early 2006 and found potential stormwater issues for source cotnrol. Ecology conducted an upland soil investigation in the vicinity of a bio-swale at the top of the bank adjacent to Slip 4, near the old asphalt plant, and determined that this was not a potential recontamination source for PCBs.

Elevated concentrations of phthalates (BEHP, butylbenzylphthalate, di-n-octylphthalate, and dimethylphthalate) have been found in sediment samples collected from catch basins and other drainage structures on the Emerald Services property. Phthalates appear to be unique to the Emerald Services property, since other drains in the Slip 4 area generally contain lower concentrations of phthalates. Further investigation is needed to determine whether phthalates are associated with specific products used at the Emerald Services and can be controlled.

The following source control actions are currently underway or will be conducted:

- Ecology and EPA will complete a historic use investigation to identify data gaps for recontamination potential from soil and groundwater (2006).
- Ecology and EPA will compile and evaluate historic water quality data (2006).
- Ecology and EPA will reevaluate past NFA determinations for sediment protection (2006).

- Ecology and EPA will determine how to fill the data gaps identified above (late 2006).
- Ecology will conduct necessary sampling and evaluate the data (2007).
- Ecology will collect effluent/runoff and in-line solids to verify the conclusions of the 2005/2006 inspections and to assess the recontamination potential from any ongoing source.
- Ecology and EPA will evaluate NPDES permits with respect to Slip 4 sediment impacts (see Section XX below).
- Ecology will reassess the bio-swale for erosion and recontamination potential for other contaminants (2006).

4.6 Boeing Plant 2

The upland history of the 17 acres of Plant 2 draining to Slip 4 is summarized in Appendix XX. Data gaps relevant to sediment recontamination include: groundwater data and information, confirmed discharge NPDES coverage, and effluent data from two outfalls to outer Slip 4. The following source control actions are currently underway or will be conducted:

- EPA and Ecology will assess existing groundwater data in the area, and determine whether additional groundwater monitoring is required to address recontamination concerns (2006 - 2007)
- Ecology and EPA will evaluate NPDES permits with respect to Slip 4 sediment impacts (see Section XX below).

4.7 NPDES Stormwater Permits

Ecology and EPA will review NPDES permit conditions for stormwater discharges to Slip with respect to the contaminants of concern found in sediments. This will include municipal and industrial permits. The following permittees are affected for Slip 4: Boeing (NBF), Boeing Plant 2, Emerald Services, Alaska Logistics, King County International Airport, WDOT, and SPU. Reviews will be completed by 2007.

4.8 In-Water Spills

U.S. Coast Guard records show no apparent spills in, or in the vicinity of, Slip 4 from 1992 to 2003. These records will be updated by mid-2006 for inclusion in this SCAP.

4.9 Business Inspections

King County Industrial Waste and SPU are leading the joint King County/Seattle business inspection program in the LDW. Inspections are conducted under existing code authorities. Since June 2004, a total of 55 businesses (all of the airport tenants and waterfront facilities,

except Boeing-owned or leased facilities) have been inspected in the Slip 4 drainage basin (46 full inspections and nine screening inspections). Boeing facilities have not been inspected by the City of Seattle and King County because inspectors were not granted access to these facilities.

Of the 46 sites receiving full inspections, 35 (64 percent) required some type of corrective action. Most of the problems found in the Slip 4 drainage were related to spill prevention and cleanup (e.g., lack of proper spill prevention and cleanup plans or inadequate employee training in spill prevention and cleanup practices). Other common problems included lack of adequate spill control materials on site and need for cleaning of onsite drainage facilities. Inspectors requested a total of 103 corrective actions in the Slip 4 basin.

As of December 2005, 88 percent of the sites that were requested to make corrective actions have completed the required changes (SPU and King County 2005b). Inspectors are working with the three remaining facilities to obtain compliance.

Business inspections in the Slip 4 drainage will be repeated as needed to evaluate pollution prevention practices and source control.

4.10 Upland Spills

Upland spills will be monitored as needed on an ongoing basis by King County, Ecology, SPU, and EPA. Depending on the nature of the spill, the origin of the spill will be identified and cleanup activities to determine appropriate post-spill source control activities that may be required will be evaluated.

4.11 Other Source Control Activities

Phthalates, particularly bis(2-ethylhexyl)phthalate (BEHP), are contaminants of concern in the Lower Duwamish Waterway. Phthalates are a class of industrial compounds commonly used as softeners in plastics, as solvents, as oil in vacuum pumps and electric capacitors, and as carriers for fragrances and pesticides. They are also often used in personal care products. These contaminants are not only found in waterway sediments, but also in stormwater and catch basin samples and in the sanitary sewers as well.

In 2003, King County and SPU joined the City of Tacoma in testing various materials and commonly used products to help identify controllable sources of phthalates. To date, the materials tested include brake pads and automotive belts, tires, packing peanuts, cigarette butts, soaps, sealants, detergents, and common household products. Atmospheric sampling in Duwamish sub-basins was recently added to the local study based on a literature review and dust samples from the Tacoma Dome roof, which indicate that atmospheric deposition may also be a source of phthalates. The municipalities will continue to investigate phthalates and possible sources to better understand phthalate loading to the waterway sediments, and possible methods of controlling those loads.

5.0 Monitoring

Monitoring efforts by SPU, Boeing, and King County are intended to assist in identifying and tracing ongoing sources of the chemicals of concern present in the waterway sediments. This information is being used to focus source control efforts on specific problem areas within the Slip 4 drainage basin and to track the progress of the source control program. The following types of samples will continue to be collected:

- In-line sediment trap samples from the storm drain systems
- Onsite catch basin sediment samples
- Soil and groundwater sampling as necessary

6.0 Tracking and Reporting of Source Control Activities

Ecology is the lead for tracking, documenting, and reporting the status of source control to EPA. In turn, all source control activities will be documented by the appropriate agency performing the source control work. The agencies will provide reports to Ecology, who will provide waterway-wide and basin-specific reports.

The management of information and data is divided into two levels. The first level is documentation and tracking, where information is organized so that Ecology can track and manage source control activities at a given source or within a given basin(s). The second level is reporting to EPA. Please refer to the Lower Duwamish Source Control Strategy for further details (Ecology 2004).

Following Ecology's assessment and before implementing cleanup actions, the City of Seattle and King County will determine whether or not source control is considered adequate to prevent significant recontamination.

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SPU 2005b Is this the Draft Progress Report on Source Control Activities?

Figures

Tables